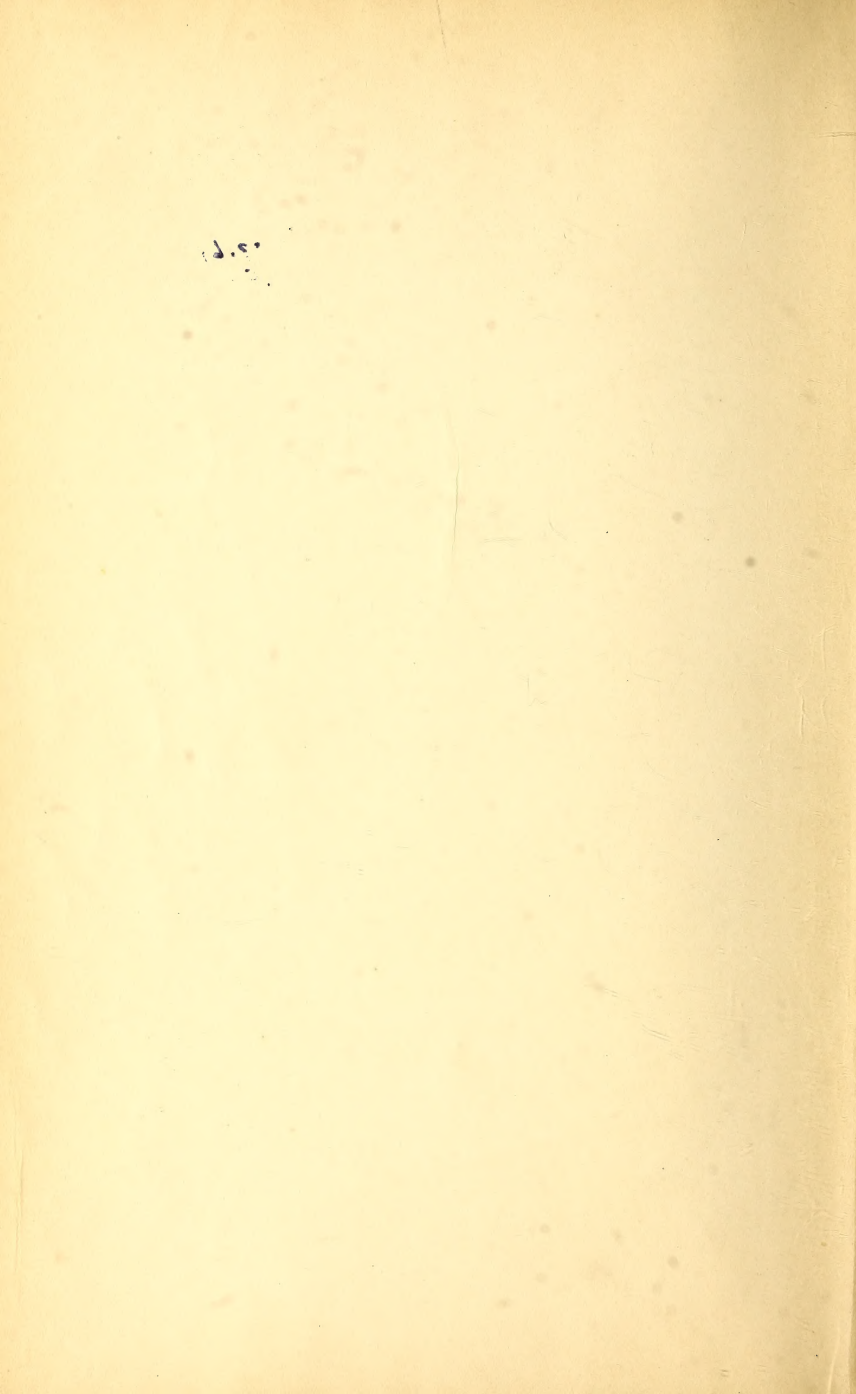


ELEPHANTS

AND THEIR DISEASES

G. H. EVANS



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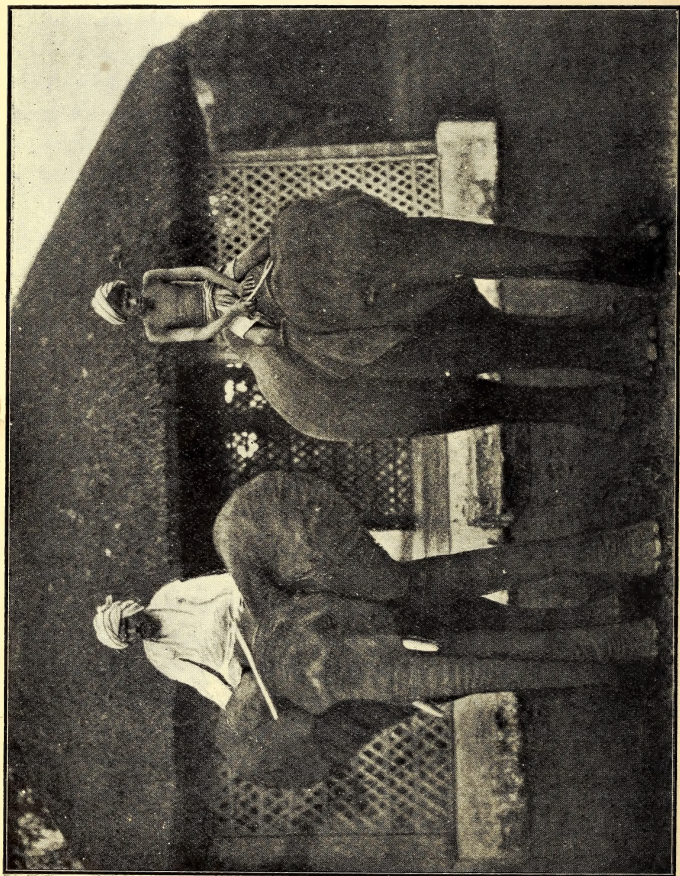
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ELEPHANTS

AND THEIR DISEASES

A Treatise on Elephants

BY

G. H. EVANS, LIEUT.-COLONEL

SUPERINTENDENT, CIVIL VETERINARY DEPARTMENT
BURMA

PUBLISHED BY AUTHORITY

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PREFACE.

THE last edition of this book was published in 1901 and has been out of print for several years. The work has now been entirely rearranged to make it more convenient for reference ; portions which appeared of doubtful or of secondary interest have been omitted ; parts have been entirely rewritten ; and considerable additions have been made from my own experience and that of others.

The book has been written primarily for the use of those entrusted with the anxious task of preventing or curing disease in elephants, rather than for those possessed of medical or other scientific knowledge. The scantiness of the literature on the subject is, I am aware, a source of embarrassment to those in charge of these valuable animals and the need of some guide embodying the latest information has been widely felt. It is hoped that the present volume will, to some extent at least, supply this want.

In many of the forests of Burma the readily accessible timber has been worked out, necessitating operations being conducted further and further afield. Thus the work of extraction becomes more and more arduous and the need for adequate elephant labour more than ever imperative, and this, too, with a steady increase in the price even of untrained or partially trained animals. The timber industry is not only the source of handsome revenues to Government but is a lucrative one for the capitalists engaged therein. The subject of elephant diseases therefore, apart from its high scientific interest, has become a matter of immense economic importance to the Province.

I regret that my appeal in the last edition for information and notes concerning elephants and their diseases has, with a few exceptions, met with little response. I trust those who are in a position to do so will favour me with any facts and observations that may come under their notice. In this connection the detailed instructions for the preparation of blood-smears, if carefully followed, may materially assist in arriving at a correct diagnosis.

I have much pleasure in acknowledging assistance from many friends and acquaintances. Messrs. The Bombay Burma Trading Corporation, Limited, Messrs. Steel Brothers & Company, Limited, and Messrs. C. B. Lacey, H. Roberts and H. F. Bowden of the Bombay Burma Trading Corporation, Limited, Messrs. B. T. Petley, H. R. Kerr, G. H. Fraser and Baker of Messrs. Steel Brothers & Company, Limited, Mr. Dalglish of the Borneo Company, Siam, and Mr. W. Hepburn, M.R.C.V.S., have at various times afforded me information. For the drawings I am indebted to Major F. W. Thomas, Major T. Robinson and Captain A. G. Stuart, of the Indian Army, and for the coloured plates illustrating *Fasciola Jacksoni*, bacteria and other organisms to Captain J. D. E. Holmes, Mr. S. H. Gaiger, both of the Civil Veterinary Department, and the Editor of the "Journal of Tropical Veterinary Science." My colleagues, Messrs. T. Rennie and C. J. N. Cameron, read the proof sheets and advised me as the book was passing through the press. Finally to Mr. R. W. Bishop, Superintendent, Government Printing, to whose care the publication was entrusted, my special thanks are due.

It only remains to add, as on a previous occasion, that the book has been written at odd intervals of official duties which involve almost constant travelling, and no one can be more conscious of its shortcomings than I. Nevertheless I am sanguine enough to hope that its publication will do something towards ensuring a better knowledge of elephants and perhaps the better supervision and health of these noble creatures.

G. H. EVANS.

RANGOON, *June 1910.*

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CONTENTS.

PART I.

	PAGE
CHAPTER I.—Supply. Age. Height. Weight. Value. Purchase. Sales. Marks of Identification	1
CHAPTER II.—General Hygiene :—On the Causes and Prevention of Disease. Feeding. Natural Fodder. Artificial Food. Times of Feeding. Watering. Work and Exercise. Power of Endurance. Paces. Rest and Sleep. Exposure. Bathing and Grooming. Attendants and their Duties	15
CHAPTER III.—Hygiene :—Gear for Dragging. Pack-gear. Care of Gear. Summary of General Hygiene	39
CHAPTER IV.—Mounting. Restraint. Fettering for Grazing. Securing for Operations. Bolting. Crossing Rivers. Quicksands. Destruction of Elephants	49

PART II.

OUTLINES OF ANATOMY AND PHYSIOLOGY.

CHAPTER I.—The Skeleton	61
CHAPTER II.—The Skin. Mucous and Serous Membranes. Muscular System	73
CHAPTER III.—The Chest and Organs of Respiration	76
CHAPTER IV.—The Circulatory System	81
CHAPTER V.—The Digestive System	83
CHAPTER VI.—The Urinary System	88
CHAPTER VII.—Organs of Reproduction. Milk. Breeding. Pregnancy. Parturition	90
CHAPTER VIII.—The Nervous System and Special Organs	98
CHAPTER IX.—Elementary Physiology	100
CHAPTER X.—Elementary Physiology— <i>continued</i>	104

PART III.

MEDICINES AND THEIR ADMINISTRATION. FORMULÆ.

	PAGE
CHAPTER I.—Preparation and Mode of Administration	109
CHAPTER II.—Instruments. Weights and Measures	113
CHAPTER III.—Formulæ—Internal Remedies	117
CHAPTER IV.—List of Useful Drugs in the Treatment of Elephants— Drugs with their Doses and Equivalent Native Names, etc.	138

PART IV.

NON-INFECTIVE DISEASES.

CHAPTER I.—General Treatment of Sickness	163
CHAPTER II.—General Indications of Ill-health	165
CHAPTER III.—Stomatitis (Inflammation of the Mouth). Disorders of the Teeth. Congestion and Inflammation of the Temporal Glands	173
CHAPTER IV.—Wounds. Abscess. Serous Abscess	179
CHAPTER V.—Ulceration. Sinuses and Fistulæ. Burns and Scalds	190
CHAPTER VI.—Sprains. Fractures and Dislocations. Cramp. Rheumatism	198
CHAPTER VII.—Diseases of the Skin :—Abrasions. Galls. Pityriasis or Scurf. Urticaria or Nettle-rash. Eczëma. Boils. Hæmatidrosis	202
CHAPTER VIII.—Diseases of the Skin (<i>continued</i>)—External Para- sites :—Blood-sucking Flies. Non-blood-sucking Flies. Maggots. Warbles. Spider-flies. Ticks. Lice. Leeches	210
CHAPTER IX.—Diseases of the Feet :—Tender Feet. Inflammation of the Feet. Cracked Sole. Cracked Heels. Abscess of the Foot. Disease of the Nails. Moisture under the Nails. Gunruss. Chowrung	218

CONTENTS.

xiii

PAGE

CHAPTER X.—Diseases of the Respiratory Tract :—Catarrh. Mumps. Bronchitis. Pneumonia. Traumatic Pneumonia	225
CHAPTER XI.—Diseases of the Circulatory System :—Heart and Larger Blood Vessels. Liver. Spleen. Kidneys. Lymphangitis	229
CHAPTER XII.—Diseases of the Stomach and Intestines :—Indigestion. Diarrhoea. Super-purgation. Constipation. Intes- tinal Obstruction. Intussusception. Colic. Enteritis. Peritonitis. Vomiting. Choking. Poisoning. Mookunda	238
CHAPTER XIII.—Diseases affecting the Brain and Nervous System :— Inflammation of the Lining Membrane of the Air Cavities of the Skull. Congestion of the Brain. Apoplexy. Paraplegia. Reflex Paralysis. Para- lysis of the Trunk and Ears. Sunstroke. Heat Exhaustion. Heat Apoplexy. Lightning-stroke	255
CHAPTER XIV.—Diseases of the Eye :—The Eye. Ophthalmia. Inflammation, Ulceration, and Opacity of the Cornea. Staphyloma. Cataract	261
CHAPTER XV.—Internal Parasites :—Symptoms of the presence of Parasites	267

PART V.

INFECTIVE DISEASES.

CHAPTER I.—General Remarks	281
CHAPTER II.—General Septic Infection and Intoxication	285
CHAPTER III.—Anthrax	288
CHAPTER IV.—Hæmorrhagic Septicæmia	302
CHAPTER V.—Trypanosomiasis—"Thut"—Elephant Surra	305
CHAPTER VI.—Piroplasmosis—Tick Fever	311
CHAPTER VII.—Aphthæ Epizooticæ — Foot-and-mouth Disease. Elephant-pox	313
CHAPTER VIII.—Rabies. Tetanus. Tuberculosis	317
CHAPTER IX.—Epidemic Pneumonia. Epidemic Dysentery. Rinderpest in Cattle	321

APPENDICES.

	PAGE
APPENDIX A.—Law Cases	325
APPENDIX B.—Operations	328
APPENDIX C.—Age	328
APPENDIX D.—Growth Increment	329
APPENDIX E.—List of Fodder Plants, Grasses, etc., eaten by Elephants	330
APPENDIX F.—Breeding	331
APPENDIX G.—Case of Impaction and Rupture of Œsophagus	332
APPENDIX H.—Surra	332
APPENDIX I.—Note on Infective Diseases with special reference to Anthrax	333

LIST OF PLATES.

African and Indian Elephant.	(From Messrs. Hagenbeck & Co.)	Frontispiece
PLATE I.—An Ideal Specimen of a Timber-working Elephant.	(From Messrs. The Bombay Burma Trading Corporation, Limited)	Facing page 9
PLATE II.—A well-known Elephant in Messrs. Macgregor's Yard, Rangoon.	(From Messrs. Macgregor & Co.)	25
PLATE III.—An Elephant, probably one of the Best-trained Animals in Burma.	(From Messrs. The Bombay Burma Trading Corporation, Limited)	34
PLATE IV.—Fine Specimen of a Cow Elephant.	(From Messrs. The Bombay Burma Trading Corporation, Limited)	50
PLATE V.—Elephants being Rafted.	(From Lieut. Rawson, R.G.A.)	57
PLATE VI.—Extracting a Heavy Log		81
PLATE VII.—Elephant Working in Jungle		109
PLATE VIII.—Ounging and Dragging		163
PLATE IX.—Cow Elephant "Ma Pu" showing loss of cartilage of ear, the result of extensive ulceration.	(From Mr. H. R. Kerr)	191
PLATE X.—Fine Specimen of a Tai.	(From Messrs. Darwood & Co.)	196
PLATE XI.—An Open Sore due to an Injury.	(From Mr. Quinn)	203
PLATE XII.—Fasciola Jacksoni		274
PLATE XIII.—Anthrax—Tetanus—Hæmorrhagic Septicæmia—Surra Trypanosomes		288
PLATE XIV.—Trypanosomes in Elephant Surra		305
PLATE XV.—Piroplasma (Cattle)		311
PLATE XVI (1, 2, 3 & 4).—Elephants at Work.	(From Mr. H. R. Kerr)	334

ELEPHANTS AND THEIR DISEASES

A TREATISE ON ELEPHANTS

PART I.

CHAPTER I.

SUPPLY. AGE. HEIGHT. WEIGHT. VALUE. PURCHASE.
SALES. MARKS OF IDENTIFICATION.

SUPPLY.

AS in other countries, the introduction of steam-driven appliances where possible, in competition with man-power or that of his servants among the lower animals, has in Burma resulted in some diminution of the uses to which the elephant is put. This, however, has not been so great as at first sight might appear, nor has it had the effect of lessening the demand for elephants in general. Steam-power in the timber industry here can only be employed in such places as the log depôts and mills, portage of machinery being anything but easy or cheap in other places, and it is here only that the elephant has been ousted from his former important and much admired duties. In Rangoon timber yards the number of elephants employed for the dragging and stacking of timber is inconsiderable. In jungle work, in hauling the logs from where they have been felled to the banks of streams or to cart-roads for transport, the elephant still proves indispensable, and for this work the considerable extension of operations by various companies interested in the timber industry has brought about an increased demand. So much is this the case, that the supply appears to be insufficient; for years prices have been on the rise, and purchasers have had to go further and further afield to furnish their requirements.

The Karens, Talmes and Laos tribes, inhabiting the country between the rivers Salween and Me-Ping, the Karens on the western side of the Salween, in Karenni, and to a smaller extent the Shans to the north, and the Laos tribes in certain parts of the valley of the Me-Nam, still continue to be a source of supply of more or less trained elephants. In this somewhat sparsely populated

and little cultivated country, intersected by rivers and mountain chains, the elephant finds a congenial home, and it is in this country, inhabited by shy and retiring people, that a number of elephants are bred in captivity. Elephants in these parts are used chiefly for transport purposes between villages, and are a conspicuous element in all festivities held by Chiefs. Young tusker calves, when not more than five or six years of age, find a ready sale among the numerous Chiefs of the Shan and Laos tribes and Siamese officials, at prices from three to five hundred rupees. As much as twelve hundred rupees has been offered for a promising ten-year old tusker. The wealth of many Chiefs consists largely of elephants, some of them owning as many as one hundred animals, and continually adding to the number. One of the great amusements of the Chiefs is to watch the training of their animals; this training begins at an early age, when the elephant is taught to submit to a man riding on his back or neck; he is then taught to carry a saddle and small load, and later to drag timber. When an animal is being taught to drag, he is taken with a trained elephant to the sandy bed of a dried-up stream and put in harness; if he is obstinate and shows temper, the old elephant is given a long tow rope which is attached to the youngster, and at a given signal he moves off, towing the youngster, who frequently falls, but is nevertheless towed along on his back or side as the case may be; after a few such lessons he learns how to drag, but it is not till an animal reaches the age of twenty that any serious work is expected of him. Till he is full-grown he is a pet and, if a fine animal, an object of admiration in a cavalcade of elephants on festival occasions.

During the last few years purchases for Burma have been made in Assam and Siam.

AGE.

The limit of age in elephants, and the indications of the age an individual has reached, are not accurately known. It is natural to suppose that in the wild state they attain a much greater age than in captivity. In the latter condition they not infrequently die prematurely from preventible causes. That they do sometimes live to a great age is pretty certain. An instance of this is recorded in Beeton's "Dictionary of Natural History," namely, that amongst the papers of Colonel Robertson (son of the historian of Charles V.), who held a command in Ceylon in 1799, shortly after the capture of the Island by the British, is one showing that a decoy was then attached to the elephant establishments at Matura, which the records proved to have served with the Dutch during the entire period of

their occupation (extending to upwards of one hundred and forty years), and was said to have been found in the stables by the Dutch, on the expulsion of the Portuguese in 1656. This, however, is an extreme example of longevity from which it would be unsafe to generalize. Burmans and Karens, having considerable experience with elephants, give the period of life from eighty to one hundred and fifty years. The former designate the periods of growth as follows :—

From 25 to 35 years, *hsin-nu* (ဆင်းနု) = immature, *i.e.*, young and soft.

From 35 to 45 years, *k'yi-b'yi* (ကြီးပွဲ) = full grown.

From 45 to 50 years, *hsin-daing* (ဆင်းထိုင်) or *mundi* (မွန်းတည့်) = "midday" or middle aged.

From 50 to 60 years, *obyi* (အိုပွဲ) or *mun-lwe-b'yi* (မွန်းလွဲပွဲ) = after midday or on the decline.

I think it is the general opinion of those who have experience of these creatures that, with the age of seventy or eighty, they generally show evidence of having reached the average term of life ; but there are no data to substantiate this opinion, still less any precise statistics available on the subject. The care bestowed varies considerably, and to enable true conclusions with regard to their age limit to be drawn, only those cases in which elephants have received adequate care and attention should be considered. "The elephant is full grown, but not fully mature, at about twenty-five years of age, but is not in full vigour and strength till thirty-five." —(*Sanderson*.)

There is little difficulty about judging the age of a young full-grown elephant or a very old one ; but it is anything but easy to tell those of middle age, especially if they are in poor condition. Much information as to probable age can be gathered from the general appearance, condition of the ears, trunk, tail, etc. The appearance of an aged animal is as follows :—General condition usually poor, the head lean, the skull appearing to have little but skin over it, deep hollows are present over the eyes, and often on cheeks (sides of face), the skin covering the forehead frequently presents a cracked and warty appearance. There is often some opacity of the eyes and an abnormal flow of water from them. The edges of the ears, especially the lower, are much torn and frayed. The skin of the trunk is rough, hard and warty, and the organ appears to have lost much of its suppleness. The skin covering the body is shiny and shrivelled. The legs are thinner than in youth, and the enormous masses of muscle seen in youth are absent ; the girth of the limbs, especially just above the feet, is considerably

diminished. The skin around the nails presents a broken and warty appearance. The tail is cakey, hard and the extremity often devoid of hair. Sanderson notes on the peculiar action of aged animals: "Instead of walking firmly, and planting the feet flat, they bring the feet to the ground somewhat in the manner of a plantigrade animal, touching with the heels first." This peculiarity may sometimes be observed in animals of middle age suffering from debility.

The most ready way of forming an approximate idea of the age is by the amount of turn-over of the upper edge of the ear. In young animals, sometimes up to the age of eight or nine years, the edge is quite straight; it, however, then begins to turn over, and by the time an animal is thirty, the edges curl over to the extent of an inch, and between this age and sixty, this increases to two inches or slightly more. The teeth afford some evidence as to age, but this is of little practical value (*see Appendix C*).

What in Burma is considered a sure sign of middle age is the condition known as *kadoung-kyeik*, that is, the animal presents somewhat the appearance of a Burman with his waist-cloth (*loongyi*) tucked up. This appearance has to be seen to be understood. The Burman belief is that once this condition appears the animal is annually liable to become *musth*.

HEIGHT.

Extravagant estimates of the height of elephants have from time to time been recorded; their great bulk so far exceeds that of the ordinary animals we are accustomed to see that the tendency is to overestimate their size. The old method of measuring was also most misleading: a rope was simply thrown over the back, the ends brought to the ground on each side, and half the length taken as the height. Much amusing information on this subject is contained in Sanderson's excellent work. Madras elephants, he tells us, were at one time said to be from 17 to 20 ft. high, and an animal at Dacca was said to be 14 ft. Mr. Corse, a gentleman thoroughly conversant with elephants, determined if possible to see one of these enormous creatures. He accordingly took the trouble to go to Dacca, and was rather surprised to find that according to his measurement the animal said to measure 14 ft. did not exceed 10 ft. in height (a very good height). We may take it on the authority of Sanderson, a most careful observer, who had unrivalled opportunities of investigating such matters, that such a thing as an elephant measuring 10 ft. at the shoulder does not exist in India, nor, may I add, in Burma. The largest male he ever met with measured 9 ft. 10 ins. and the tallest female 8 ft. 5 ins. Cingalese

elephants are said to seldom exceed 9 ft.,* and the ordinary herd elephants do not average more than 8 ft.

Of 300 males measured in this Province, the average height was 7 ft. 10 $\frac{1}{2}$ ins., girth 11 ft. 10 ins.; and of 100 females, the average height was found to be 7 ft. 5 $\frac{3}{4}$ ins., girth 10 ft. 11 ins. All these animals were measured at the shoulder as is done with horses. An elephant dealer, through whose hands some two thousand elephants had passed, stated that he had only met with one animal measuring 9 ft. 4 ins. at the shoulder. Mr. C. B. Lacey informs me that in Siam the tallest animal owned by the Bombay Burma Trading Corporation measures 9 ft. 6 ins. at the shoulder. This fact shows how rare it is to come across an animal 9 $\frac{1}{2}$ ft. and over, for the Bombay Burma Trading Corporation have records of a thousand and more animals, yet this is the only one they possess measuring 9 ft. 6 ins.; and at the present time they have some 2,000 or 3,000 elephants in their employ.

Details of measurements of 300 male elephants—

			Ft. in.		Ft. in.
23 animals or	7'67	per cent., height	7 0	and under	7 6
57	"	19'0	"	"	7 8
94	"	31'33	"	"	7 11
67	"	22'33	"	"	8 2
59	"	19'67	"	8 3	and above.
300	100'00		average		7 10 $\frac{1}{2}$

Of the above number, there were only two animals 9 ft. and over, namely, one exactly 9 ft. in height with a girth of 14 ft. 9 ins., the other 9 ft. 1 in. with a girth of 13 ft. 9 ins.

Details of measurements of 100 females—

			Ft. in.		Ft. in.
48 animals or	48	per cent., height	7 0	and under	7 6
35	"	35	"	"	7 8
13	"	13	"	"	7 11
4	"	4	"	8 0	"
100	100		average		7 5 $\frac{1}{4}$

The above measurements were taken haphazard from the recorded measurements of considerably over 800 animals. The males from 7 ft. and under 7 ft. 6 ins. were probably not fully grown, yet were sufficiently so to be working, and in all probability unlikely to grow much more (*see* Appendix D).

Burmans give the height of elephants in cubits, the "cubit" employed by them being the ordinary cubit *plus* a hand's breadth or roughly 21 ins.

* Emerson Tennent—"Ceylon," 1859.

As stated above, these animals should be measured like horses, *i.e.*, vertical measurement taken at the shoulder. Twice the circumference of the foot is as nearly as possible the height at the shoulder. This rule, however, does not always hold good in the case of young growing animals. The following observations by Mr. B. P. Kelly, of the Forest Department, are interesting:—"My young elephant, a *haing*, born in September 1893, measured in February 1903, 6 ft. $1\frac{1}{4}$ ins. Measurement in February 1904 showed 6 ft. 9 ins., growth increment for the year being $7\frac{3}{4}$ ins. A very peculiar thing about the young beast is his enormous feet, out of all proportion to his size. The generally accepted theory of twice round the feet does not hold good in his case, for the circumference is 3 ft. 9 ins., twice round which, 7 ft. 6 ins., is 9 ins. over his height."

WEIGHT.

Gilchrist gives the weight of the carcase of an ordinary-sized elephant as follows:—

"In conducting the weighing of the carcase in portions, as stated below, every regard was paid to ensure a correct result, and I consider the one given to be within a very few pounds of the exact weight of the living animal:—

	Cwt.	qr.	lb.
Head (including brain, which weighed $16\frac{1}{2}$ lbs.) ...	4	0	22
Left fore-leg	2	2	25
Right fore-leg	2	2	14
Left shoulder	0	3	18
Right shoulder	1	0	7
Left hind-leg	2	2	11
Right hind-leg	2	3	0
Left ribs	1	1	$20\frac{1}{2}$
Right ribs	2	0	26
Loins and part of buttock	3	0	16
Pelvis	3	1	$19\frac{1}{2}$
Neck	0	3	13
Breast-bone	0	3	0
Heart	0	1	14
Lungs and diaphragm	0	3	14
Kidney	0	0	16
Intestines (small and large bowel)	2	1	23
Liver	0	2	$20\frac{1}{2}$
Spleen	0	0	$4\frac{1}{2}$
Stomach	0	3	12
Weight of carcase and organs ...	34	0	16
Dung weighed	2	1	9
Water in bowels and cavity of abdomen, about ...	2	1	18
Total weight ...	38	3	15
Pounds, Avoirdupois ...	4,355		

"The dimensions of the animal were as follows:—

					Ft.	in.
Height	...	...	...	...	7	4
Length from top of forehead to insertion of tail	...	...	...	...	10	1
Round abdomen	...	...	...	...	13	8
Length of intestines—						
Small intestines	...	...	...	...	68	0
Large intestines	...	...	...	...	38	3
Total length of intestines						
					106	3

"Skin about $\frac{3}{4}$ of an inch to 1 inch thick, thickest about the loins and buttocks.

"Depth of the carotid artery from the surface of the neck, 4 inches; diameter of the carotid artery, $\frac{3}{4}$ of an inch.

"Jugular vein in close proximity to the carotid artery, about $\frac{1}{2}$ an inch. The dimensions of the animal taken while alive will show the carcase thus weighed piecemeal was of more than average size."

The following weights of eight live animals with the measurements of each were kindly furnished by Mr. Kerr, of Messrs. Steel Brothers at Pyinmana, who succeeded in having the nett weights taken on a weigh-bridge:—

Weights and Measurements of Elephants.

No.	Sex.	Approximate age.	Height.	Girth.	Length along back.	Length along side.	Weight in pounds.	Remarks.
			Ft. in.	Ft. in.	Ft. in.	Ft. in.		
1	Female ...	30	7 8	11 2	10 8	7 10	6,278	In good condition.
2	Do. ...	20	7 1	10 3	9 10	6 10	5,237·75	Do.
3	Do. ...	35	8 3	11 3	10 9	7 7	6,296·25	Do.
4	Do. ...	30-35	7 3	11 2	10 6	7 6	6,322·5	Do.
5	Male ...	30	8 4½	11 7	11 4	...	6,460·5	Do.
6	Do. ...	40	8 1	11 3	11 0	...	5,931·75	In poor condition.
7	Female ...	30	7 8½	11 4	10 4	7 9	6,322·5	In good condition.
8	Do. ...	30	7 8½	11 8	10 0	7 6	5,748·75	Do.

Average height—7 ft. 9 $\frac{1}{10}$ ins.

Average weight—2 tons 14 cwt.

VALUE.

Elephants may conveniently be divided into two classes, namely,—

- (a) timber elephants;
- (b) baggage or travelling elephants.

Timber elephants may again be divided into two classes, namely,—

- (i) trained tuskers,
- (ii) trained males and females.

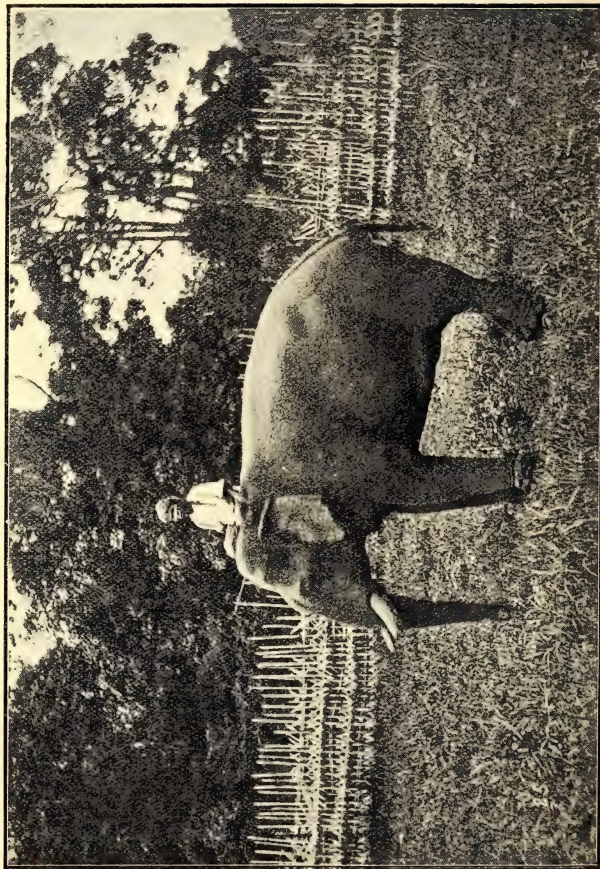
Well-trained tuskers have at all times commanded a good price; they are much more useful both in the yards and forests, as with their tusks they can “oung” (အောင်) (*see* Plate VIII), *i.e.*, butt and stack timber, carry butts and planks, assist in getting logs over obstacles, or in clearing blocks in creeks. Prices vary according to age, good points, temper, training, and length, thickness and sweep of the ivory. Merchants have been ever ready to pay what a few years ago were considered fancy prices for well-trained elephants, but of late the demand has been so great that prices hitherto considered exceptional have now become, for the time being at least, ordinary rates.

A full-grown well-trained tusker will command as much as Rs. 7,000, and a well-trained female as much as Rs. 5,000. Elephants that are trained to baggage work or slightly to timber may cost Rs. 4,000. How long this abnormal state of the market will exist it is difficult to predict. Though tuskers are largely employed in dragging operations, still most of such work is generally performed by tuskless males and females. Most Burmese elephants are trained to timber work, and to some extent to carrying baggage. As before noted, purchasers of late have had to go far afield to obtain what they want. Competition among firms in the timber industry has been keener of late, added to which several new firms have entered the field. Again, the business of catching and training wild elephants, by the lesser lights, has been prohibited for some time in Burma, and this no doubt has helped to diminish the supply of trained elephants. These causes operating together have all tended to raise the price, and I have no doubt the price will remain high so long as they are in operation. In the interests of the timber industry in which Government is directly concerned, it would appear highly desirable to do something towards trying to reduce these abnormal prices.

PURCHASE.

Dealers in elephants, it is to be regretted, are not always above suspicion; and as elephants are subject to numerous ailments, which are causes of unsoundness, and also sometimes obscure vices, too much care cannot be exercised in the examination of animals about to be purchased. It will therefore be advisable to enumerate some

PLATE I.



AN IDEAL SPECIMEN OF A TIMBER-WORKING ELEPHANT.

Indications of enormous power in head and trunk ; neck short and thick ; stands well up at the shoulder ; sloping down gradually behind ; short hind-limbs indicating great dragging power. Tusks and curve of back perfect. Height about 7 feet 10 inches.

of the more prominent signs of health. These are constant motion, such as swinging of the trunk and tail, flapping the ears, swaying the body or the head from side to side, rubbing one leg against the opposite one, or swinging it. The skin is soft, almost black in colour, and the bristles covering the body are firm to the touch. The mucous membrane of the tongue and mouth is of a rich pink colour; the eyes clear and bright. The light-coloured spots and blotches on the head and trunk are pinkish in colour. A moist secretion exudes around and above the nails, and is easily observed by throwing some dust on the parts; this must not, however, be confounded with an offensive discharge from beneath the nails, a wet rot, which runs high up, the affected parts being hot and painful. The appetite is good, and the animal sleeps for a few hours every night, and immediately on waking commences to feed.

The signs of indisposition are that the animal is listless, there is general languor, absence of the incessant motion so characteristic in health. The skin appears greyish in colour, hangs loosely, and is dry and sometimes scaly; the spots and blotches also assume this pale colour. The trunk presents a shrivelled appearance. The colour of the membrane of the mouth and that of the tongue changes to a muddy colour or is deep red, with or without blotches on the palate. The lower flap of the ear is very often cold to the touch, the eyes are dull, appear retracted, and there is frequently an abnormal flow of water from the eyes. The animal may be out of condition and feverish, the appetite small or even wanting; proper rest is not taken, and he may lie down and get up several times (generally a bad sign). If the excretions be examined, the urine may be noticed to be small in quantity and high coloured, and the dung hard and coated with mucus, or diarrhœa may be present.

Elephants differ as widely in their points as do horses and other animals. The chief points of a good elephant are as follows (*see* Plates I, II, III, IV and X), namely, medium height, a good big barrel, skin soft and wrinkled (described by Burmans as crocodile skin), the head massive, full cheeks and a broad forehead; the ears large, eyes bright and kindly, and free from opacity or excessive flow of tears; the trunk of good length, broad at the root, and blotched in front with pinkish coloured spots. The neck short, thick, and full; chest broad; the back straight and broad, broad loins; short forelegs, convex in front (described by Burmans as ချင်ထိုင်, *i.e.*, set up like a lion or *chinthay*, ချင်ထိုင်, the attitude given to the leogryphs in front of pagodas). The hind-quarters full, sloping well down and supported by thick short limbs. The pads of the feet hard, nails smooth and polished, action free, paces fast and easy;

the tail should be of good length, free from hardness, and provided with a good tuft of bristles. Animals such as described will not often be met with; still when selecting, it will be as well to obtain those possessing most of the good points enumerated.

The undesirable points are numerous. Some animals are flat-sided, others have high arched backs, with very prominent spinal ridges (*see* Fig. 1); others are narrow-chested, with lean low fore-

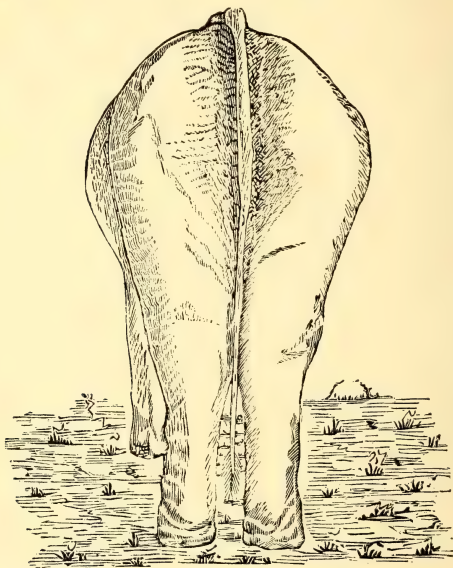


FIG. 1.—Elephant with prominent spinal ridge. After Sanderson.

quarters, or are leggy, and devoid of those enormous masses of muscle seen on the fore-limbs of a good elephant. In some animals the legs are of almost uniform girth throughout; tall leggy beasts and those with bad fore-quarters are invariably rough in action and slow in their paces; they are, moreover, much more liable to gall, and are generally indifferent workers. Elephants with thin, light-coloured skins, even if they possess many good points, should be avoided; they are as a rule not strong, and frequently fall sick. Those animals possessed of lean heads, hollow cheeks, small restless eyes, shortish thin trunks, should be treated with suspicion, as they very often are bad-tempered.

Forsyth in his work, "The Highlands of Central India," mentions that there is no end to the tricks carried out by dealers, of which he had some experience at the Sônpur Fair; some he remarks on are man-killers reduced to temporary harmlessness by the daily administration of pills containing opium and Indian hemp, sores of the feet plugged, cracks "paid" with tow, and sore backs surface-healed. It is most important therefore that in examining a beast the utmost care should be exercised to see that the back and other parts liable to gall are free from sores, scars and tenderness; in fact, the whole body must be inspected, the ears examined for sores and scabs, the ear holes for discharges, and the eyes must be free from dimness.

The soles of the feet should be well tapped all over before and after exercise; if any tenderness is manifested, the part must be thoroughly examined. Tender patches from excessive wear may readily be detected by the parts being smooth and pinkish in colour. The skin around the nails, as also the nails, must be inspected. Food and water should be presented to see that the trunk is quite sound, as this most important organ may have been injured by bamboos, spear wounds, *da* cuts, etc.

Any individual idiosyncrasy which may exhibit itself, if bearing on the utility of the animal, should be taken into consideration. Some elephants are full of nasty tricks; intending purchasers must therefore be on their guard, and endeavour to ascertain the peculiarities of any particular beast before taking possession. Most Burmese elephants prefer being approached from the right side; very few from the left; some may be approached from right and left, and others only from the right or left. A new keeper unacquainted with such peculiarities incurs the likelihood of being attacked if the animal be bad-tempered, or of scaring him if of a nervous disposition.

The following peculiarities in some animals reduce their value, as they are regarded with superstitious dread by the Burmese. It is thought that the ownership of such creatures may cost their masters loss of life or substance:—

(1) A loose fold of skin, descending from the throat down to the fore-legs, known as *pyazwe* (ပျားစွဲ, resembling bees settling in a swarm).

(2) Same as above, but the fold of skin is continued between the fore-legs on to the abdomen, called *kalaga* (ကလ္လိကော, like a purdah).

(3) Moving the head up and down, and simultaneously from left to right, called *moungdoun* (မောင်းတောင်း, like the action of pounding rice in an ordinary Burmese rice mortar).

(4) Swinging the trunk only to the left and right, called *pa-ket-hlwe* (ပုခတ်ထွဲ, rocking the cradle).

(5) A restlessness of the whole body, somewhat after the fashion of bears, called *sa-gaw-waing* (ဝေကောပိုင်, action of a winnowing tray).

(6) Holding the trunk up in the air and putting it into the mouth, called *tein-nyun-sa* (တိမ်ညွန့်စား, literally to eat the clouds), star gazing.

The conformation of an animal naturally affects its value. *Wet-kôn* (ဝတ်လန်း, pig's back), or flat backs, are considered best suited for carrying purposes.

Nga-phai-kôn (ငါးဖယ်လန်း, like the back of the *nga-phai* fish, i.e., an even curve), or those with a slight curve of the back, are considered best for dragging purposes, as it is supposed that the dragging gear fits this class of animal better than others.

Those animals with backs described as *pyat-that-kôn* (ပြောင်ထန်လန်း, like the curve of a *pyat-that*, or sharp curve) may be employed for dragging or carrying, but great care must be exercised in attending to the gear, as such animals easily gall.

A loose fold of skin across the lower part of the neck, called *payit* (ပါးရစ်), is not a bad omen and rather raises the value of the animal.

Some elephants have four nails only on each foot; this decreases their value, as five nails on each foot raises the same; four on each of the front feet and five on the hind ones does not interfere with their value. Out of a total of 623 Indian, Burmese and Siamese elephants, only three possessed twenty nails $\frac{5-5}{5-5}$, 500 had eighteen $\frac{5-5}{4-4}$, 104 sixteen $\frac{4-4}{4-4}$, and 16 seventeen toes $\frac{5-4}{4-4}$.

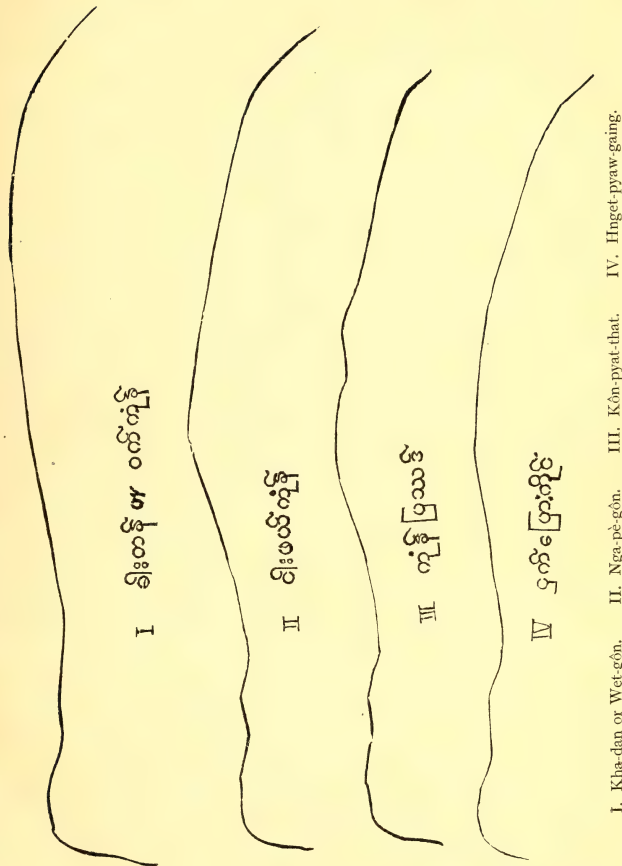
The male elephants called *han* (တန်) and *haing* (တိုင်) are often from 30 to 40 per cent. cheaper than tuskers. Generally speaking, they are inclined to be ill-tempered. These are probably the animals mentioned by Steel as always found single. I think their solitary life is usually not of their own seeking, but is brought about by the presence of powerful tuskers which resent their mixing with the herd, for if they can decoy a cow from a herd, or pick up with a tame female, they will do so.

A register recording age, height, sex, marks, year and place of purchase, price, name and residence of vendor, should be kept for reference.

SALES.

Elephants are bought and sold like other cattle, that is, the purchaser pays for the animal and takes it away. When Europeans contemplate purchasing elephants, it is advisable to come to some

DIAGRAM OF SOME BACK CURVES.



arrangement with the vendor regarding a trial of the animals offered for sale. A good plan is to advance the vendor fifty or even one hundred rupees for a week's trial of an animal; at the end of which period, should the intending purchaser decide not to buy, he forfeits his advance. This course is recommended for several reasons; the animal produced for sale may have been lost or stolen; a vicious beast may be drugged with opium or ganja, or it may be a weakly old creature fattened up for sale. The intending purchaser at least has an opportunity of observing the idiosyncrasies of the animal, also his working capabilities. Elephant-dealers, and some owners, are not above "doctoring" animals for sale. Some years ago Government directed that no sales of elephants should have effect except on fulfilment of certain formalities prescribed for the purpose. The object was if possible to place a check upon the extent to which elephant-stealing had attained. The measures, however, having failed, the regulations have been set aside. There is an impression current that a bill-of-sale is necessary in the case of an elephant; this however is an error. Registration is prescribed for the sale of immovable property only. The solitary advantage the purchaser could derive from registering his purchase would be that, in the event of the animal having been stolen property, his honesty in the transaction would be open to no question.

MARKS OF IDENTIFICATION.

Particular attention must be paid to all marks as a means of identification, as elephant-stealing about the frontiers is a popular and very remunerative pastime. In the forests, when the day's work is finished, the foresters as a rule put cane fetters on their animals, suspend a bell or wooden clapper (ခေဝေဝေ), *hka-louk*, from their necks, and then turn them loose to graze; no watch is kept over the animals at night. The thief or thieves (who thoroughly understand the habits of elephants) hang about close by, waiting till the animal selected strays, when they go up remove or cut through the hobbles, mount him, untie the clapper, and then head for the frontier. To persuade the elephant that there is every need for hurry, a man behind makes use of an instrument somewhat resembling a cat-o'-nine-tails. It consist of a wristband carrying numerous tails at the end of each of which is a cube of lead. The hills, clad as they are with dense jungle, afford ample shelter; the owner, when he suspects that the animal is stolen, usually has the good sense not to waste time in pursuit. Accomplished thieves make a good deal of money, for they steal an elephant in our territory, sell him in Siam, steal him again a month or so after, bring him across our

frontier, and once more dispose of him to some one at a place many miles distant from where they originally stole the beast. Distinctive marks are as a rule not very numerous on these creatures. Government animals are not branded,* but those owned by firms frequently are. The shoulders or quarters are the usual places. There is an idea that brands do not do well on the skin of the elephant; this is not the case when carefully done. I have seen many elephants carrying clear brands free from blemish. Elephants with any blemishes about the shoulders or quarters should always be looked upon with suspicion, as they are likely to be stolen animals, the brands having been tampered with. All brands should be large and clear.

Efforts have constantly been made to place in the hands of stock-breeders a more humane and more satisfactory means of branding their animals than by the time-honoured method of the hot iron. Experiments have been made from time to time with caustic branding compositions which should prove painless and leave a plain and permanent brand. In Burma certain compositions have been tried by brushing the paste over a stencil; the operation seems to produce no pain but the length of time taken for the scab to fall off is considerable. Perhaps the patented branding compositions may be tried. The inventors claim that—

- (a) The brand may be used in any weather.
- (b) No fright as brand is painless.
- (c) The brand is not even deep enough to prove injurious to hides when tanned.

The "Rodin" Branding Composition for life-time marking of animals may be obtained from Messrs. Hauptner.†

Mode of application.—Clip any hair at the seat of operation; stir the composition well before pouring a portion into a shallow dish or plate to ensure the branding stamp being evenly dipped. Apply the branding stamp armed with the composition, and press firmly for a few moments.

Messrs. Hauptner will supply dish, figures or letters of any size or any combination "To order."

* Quite recently Government has been carrying on some experiments on Kheddah elephants with branding compositions.

† Messrs. Hauptner, N. W. Luisen-Strasse, 53, Berlin.

CHAPTER II.

GENERAL HYGIENE :—ON THE CAUSES AND PREVENTION OF DISEASE.
FEEDING. NATURAL FODDER. ARTIFICIAL FOOD. TIMES OF
FEEDING. WATERING. WORK AND EXERCISE. POWER OF
ENDURANCE. PACES. REST AND SLEEP. EXPOSURE. BATHING
AND GROOMING. ATTENDANTS AND THEIR DUTIES.

CAUSES AND PREVENTION OF DISEASE.

Though a certain amount of predisposition to disease may be assigned to a change from freedom and a natural life to domestication and an artificial one, and to accidental causes which cannot perhaps be anticipated and accordingly prevented, there undoubtedly is a very considerable amount of disease which can be directly attributed to conditions to which the domesticated animal is subjected, and which, with proper care and humane consideration, can be greatly or wholly avoided. Twenty years' experience in this Province, during which time I have had abundant opportunities for observing domesticated elephants and their treatment by masters and mahouts, has compelled me to believe that in many instances (and I say so with reluctance) a maximum amount of labour is exacted with a minimum regard bestowed upon their wants and creature comforts—in other words, they are “sweated.” This failing is mainly due to ignorance on the part of supervisors with regard to the habits and peculiarities of their charges, and consequently they are incompetent to criticise the actions of mahouts and attendants. Employers seem to gauge the capacity of the animals for work by their huge bulk and strength, and imagine that their constitutional strength is commensurate, or fail to give this important matter its due consideration. The result of these shortcomings, whether the neglect be wilful or due to ignorance, is shown by the only too frequent ill-health tame elephants suffer from.

My experience of elephants as transport animals is that they are decidedly good. Provided they receive proper care and supervision, they do not as a rule fall sick, and are capable of performing a vast amount of work. They have few vices, are gentle, obedient, and patient. Too frequently, however, they do not even receive the ordinary attention bestowed on other transport animals, being left to the tender mercies of the native attendants, and they are in

consequence often neglected, and as a result unjustly condemned. Though of such great size and strength, if neglected they rapidly go to pieces. They are constantly disabled from sore backs and feet, the majority of such cases being due to want of a little care and supervision. As with all animals, the first and most important matter to attend to is that they be allowed an ample allowance of drinking water and abundance of food, and above all, the greatest care must be taken to ensure that they *receive* their allowance. On service, where animals cannot be permitted to graze, it is imperative that the persons in charge should see that they receive a sufficiency of food and water. Elephants require only a small amount of sleep, but to ensure their obtaining it all food should be presented to them at an early hour of the evening, as otherwise they spend the night munching their food and get no sleep at all. Care must be taken to see that they are carefully loaded, not overloaded (which is too often the case), not recklessly exposed to heat, that parts exposed to irritation are regularly examined before and after work, also that they are not overworked, and are at all times saved unnecessary labour; then, and then only, will those in charge be repaid for their care and attention.

FEEDING—NATURAL FODDER.

If an elephant is to be kept in health, it is essential above all things that he be allowed a plentiful supply of good food, otherwise careful management in other respects will be of little or no avail. Remarks on the subject of fodder apply principally to those animals which are tethered and fed at their standings, namely, animals working in yards, and of course most Government animals. In this Province all others have to forage for themselves, that is, when work is finished the mahouts are supposed to take them always to a part of the jungle where good fodder is procurable. The fore-feet are simply hobbled with the cane fetter (ဗြဲဆူး, *kyein htoo*) (Fig. 15) which is lashed between the legs with a piece of rope, or when animals are given to straying far, a long chain is sometimes put on a hind-leg, the free portion dragging behind. In Karenni, Shan States, Siam and Tenasserim, iron locks and fetters are also used. This operation completed, the animals are set free. In order that they may be readily found when required, a bell or large wooden clapper (ခလောင်း, *hka-louk*) is suspended from the neck; this in the stillness of the jungle can be heard for a considerable distance. With regard to the plants most appreciated, this can only be studied by observing the fodder usually chosen by wild animals, and this without doubt consists mainly of grasses, tree fodder being of secondary importance. The habits of wild elephants are peaceful, their

wants can lead to no rivalry, and fodder in the places they resort to is obtained in luxuriant profusion and without effort. They wander about a good deal according to the season of the year; at times they keep to the hills, at others they are to be found in the low country; generally speaking they spend the greater part of the day in dense shady jungle, where they rest and browse on the leaves and branches of young trees. They traverse the bamboo tracts, but except when the young shoots are sprouting at the beginning of the rains, or where regeneration of the bamboos has recently taken place, they do not remain very long in these localities. They visit the water morning and evening, and my experience is, that when possible; in coming to drink and bathe, they select those places where there are patches of so-called *kaing* grass (ခိုင်ဝဇ်, Hind. *kussullut*) and (ကျူ *kyu*, Hind. *null*).

It may justly be concluded that the succulent stems of the *kaing* form the most important item of the elephant's daily food; so much so, that we may accept it as the staple for animals in captivity when this grass is procurable, as it is at nearly all times of the year (the months perhaps in which the fires rage being excepted, mid-February to April). So fond are wild elephants of this grass, that I have on several occasions during the rains, when the sky is dull and overcast, known a herd to remain for days in large stretches of it. If wild animals be watched when grazing, it will be observed that after tearing off a bunch of grass close to the roots, they remove the dirt adhering to the stems by beating it against their legs or sides, after which they simply bite off the lower third, which is fresh, sweet and succulent; tame ones naturally do the same if allowed sufficient fodder to permit of such waste—a rare occurrence. A large margin should always be allowed, as elephants are given to trampling and soiling a certain amount of their ration; this they refuse to touch. If the residue be weighed after an animal has finished his meal, it will be found to be a good slice off the ration; hence, if only the bare allowance be given, an animal may gradually lose flesh owing to his being half-starved. With regard to grass then, he should not be stinted. I may state that at least from three hundred and fifty to four hundred pounds of *kaing*, where procurable, freshly cut morning and evening, should be a necessary portion of the daily fodder. The quantity mentioned is a preliminary index to what the average animal will consume. The true criterion as to quantity is, however, not to be sought in any fixed standard such as height, but in the animal's ability to dispose of it during twenty-four hours, presupposing always that the fodder is to his taste, fresh, sweet, clean and succulent. Some kinds of grass, such as *kyu* (ကျူ, Hind. *null*) for instance, *myet-thin-dóng* (မြတ်သင်တုန်း), and rushes

like *wet-la-myet* (ဝတ်လာမြေ) may also be given, when it is difficult to procure *kaing*; most of them however are far less appreciated by elephants.

In addition to the supply of good food being plentiful, it must also be varied; but here again the conditions of food-supply in Rangoon, as I have observed, do not agree with my ideas on the subject. In Rangoon, fodder is usually brought in boats, and consists invariably of *wet-la* (ဝတ်လာ) and *myet-thin-dông* (မြေထင်ထွန်း). With reference to the former (*Paperus pangoree*, *Cyprus tegetum*), it is one of the least nutritious kinds of fodder that could be supplied, as it is full of watery sap, is a poor substitute for *kaing*, and probably accounts for a good deal of the indifferent health and reduced capacity for work exhibited by many of the yard elephants (which, in my opinion, are through ignorance half-starved). For a creature to derive sufficient sustenance from it, a very large bulk must be ingested, which unduly taxes its digestive capabilities; added to this, being cut in stagnant marsh lands, it may have adhering to it the ova of many varieties of noxious intestinal parasites, as well as germs of disease, and is often provocative of diarrhœa. Thus, for want of proper supervision it usually happens that a considerable quantity of dead stalks and other unwholesome material is mixed with it. I have observed that usually the custom is to allow so many bundles for each animal, but I have never seen yet a European supervising the *weighing* of the fodder to ensure that each animal receives an adequate allowance, which I have often found was not the case. How often is any other kind of fodder supplied? I fully realize why this food is presented year in and year out: it is undoubtedly the easiest procurable near Rangoon, but with a little more trouble and very little extra expense, if employers would insist upon it, far superior fodder could be and should be substituted or mixed with this *wet-la*. In out-stations the animals are sent out to graze or taken out into the jungle, and when fodder is collected they carry it into camp. Those in charge must not be led away by the sight of the mahouts bringing in large loads of fodder on their elephants' backs; nothing short of personal inspection and weighing is satisfactory; contractors are in most instances quite as bad as mahouts; every bundle must be opened out and examined and all dirty worthless stuff rejected, such as slimy grass, insect-eaten leaves, and branches and leaves that have been soiled by birds. I know from experience that mahouts are frequently too lazy to obtain good grass, even when it can be procured a mile distant from camp; this is notably the case when on the march; they think as long as they can deceive the person in charge by bringing in a load of worthless stuff (which plan often answers their lazy inclinations

admirably), their duty is done, and it is a matter of little consequence to them how much or how little the animals may eat. These men, owing to the fact that it is easier to lop off branches than to collect good grass, are fond of reporting that there is no good grass near camp. Every means must be taken to ascertain the truth of such statements, as though grass may not be plentiful in the immediate vicinity, it may be abundant only a short distance away. The elephant is far too much in the hands of his mahout, receives insufficient supervision, and I venture to state that, were more consideration given to the above remarks, more work could be exacted, better health maintained, and there would be less need to refer to the subsequent pages. The other varieties of food which elephants consume in their natural state are numerous, such as leaves, bark of trees, palms, canes, creepers, fruits, etc.; even could we ascertain what they all were, it is most unlikely that they could be procured in great abundance for use in the dépôts. Branches of certain trees may be given to augment or vary the ordinary grass fodder, and may on emergency replace it. Of those readily procurable may be mentioned the peepul, banian, and other varieties of the *ficus* (which genus is well represented in Burma), the *sindong-ma-nwe* (*Tinospora nudiflora*), jack tree, young shoots and feathering tops of a great variety of bamboo, palms, paddy, millet and maize straws, all kinds of grain (growing or dry), sugarcane, plantain leaves and stems, fruits such as pine-apples, plantains, melons, bael, jack, palmyra, cocoanuts, yingan and other jungle fruits are all much appreciated. Whenever circumstances permit of elephants being set free to graze and choose their own fodder, the opportunity should not be neglected; nothing is more conducive to their health; so much so, that enfeebled and diseased animals will more often recover by this practice than by any other treatment.

Other varieties of green fodder may be used, such as—

Kussullut	...	အိုင်း	...	Kaing.
Rakhshee, Ghond...	...	ဝတ်လာ	...	Wet-la.
Ghut (Eleusine)	...	ဆင်ခိုမြိတ်	...	Sin-gno-myet.
Nagar Mootha	...	မြိတ်ဆိုးတင်ခွ	...	Myet-thôn-tin-gwa.
Null	...	ကျူဝင်	...	Kyu-bin.
Peepul	} Ficus {	...	ညောင်နီ	Nyaung-ni.
Goolar		...	သဖန်းသး	Tha-hpan-thi.
Banss, Bamboo	...	ဝါးရွတ်	...	Wa-ywet.
Kuss, Kusa	...	မြိတ်သင်ထုန်း	...	Myet-thin-dôn.
Tarra	...	ဂုံခင်း	...	Gon-min.
Dhull	...	ထောင့်ဂုတ်ပျော	...	Taw-hnget-pyaw.

It has been explained in the foregoing pages that whenever *kaing* grass is procurable it should be given in preference to anything else. The daily quantity of green fodder should differ in accordance with the quantity of dry fodder (straws) allowed; yet I can strongly recommend that whenever practicable each animal should have as much green grass as it can consume.

At times green crops that have partially failed and are no good for reaping should be bought up. As is well known to all cultivators in jungle tracts inhabited by elephants, these animals are very fond of growing crops—a fact only too well evidenced by their many depredations.

Sanderson made numerous experiments with regard to the quantity of the fodder elephants will eat, and gives most interesting information on the subject. He states: "800 lbs. may be looked upon as the *minimum* weight of good fodder that should be placed before full-sized elephants per diem." He has seen a tusker eat 800 lbs. in eighteen hours; he also remarks on the *insufficiency* of the fodder usually placed before them.

It may be said with truth that most grasses, the leaves and branches of many trees, in fact most green stuffs, are acceptable. No amount of grain will compensate for a continued short allowance of fodder. When good fodder is abundant, the extras may be reduced in quantity or entirely dispensed with.

The leaves and branches of the peepul tree (*nyaung-ni*) are reputed to be heating and should therefore be given sparingly. Plantain stems and leaves are not recommended in cold weather. When dry fodder is given for a short time, such as stems of maize and millet, a change to green fodder will be necessary. Sanderson points out that branches and leaves are best for food when the twigs snap rather than bend under pressure; the branches are not relished when the sap runs. Only the inner bark of the stems of the larger branches is eaten, but the whole of the smaller branches.

The great thing is to see that the animals have plenty to eat and that the fodder is always of good quality, clean and to their taste. Elephants are fastidious beasts and will not eat anything. It is desirable not to permit them to graze in swamps or in inundated country (see Appendix E).

ARTIFICIAL FOOD.

In so far as the domesticated elephant is in an artificial state, his natural diet must be modified and supplemented, and more particularly so in the case of working elephants. If the animal in his natural condition, in which he develops a very small degree of

energy, requires the whole day and the greater portion of the night to feed, whereby he may be able to replace that energy, then in the domesticated state when a greater consumption of energy is demanded and a reduced time prescribed for the repair of the loss, food must be supplied in a more concentrated form. Whatever the practice of native owners may be to the contrary, common sense, no less than the percentages of mortality among native-owned elephants, points to the propriety of giving working elephants a daily *ratib*. The *ratib* may consist of rice, paddy, or coarse flour. Our object is to supply increased nourishment without undue stimulation. Rice fulfils these conditions very well, and gives good enough nutritive results with a minimum expenditure of energy on the digestion. Twenty to thirty pounds of rice per diem is the *ratib* most in favour, although paddy is also occasionally given, either alone or with an equal quantity of rice. If the rice or paddy is coarsely bruised, it is more easily digested. The husk of paddy is believed by many to cause irritation of the bowels, especially when given dry. It may on rare occasions do so. Government elephants, when given rice, are allowed some paddy straw in which the grain is enclosed in small bundles to prevent waste. This I think is superfluous, as in my experience they do not waste much. Wheaten flour is commonly given in India; it is made up into native cakes or *chupattees*; it may be given in the form of a cake which may be sweetened with raw sugar, known as *gur* or *jaggery* (ထင်းကျက်), or *mudh* (honey, ဖျားရည်); dhall (ပဲစင်းပုံ) and onions (ကြက်သွန်နီ) when cooked may be incorporated with the loaf. During the hot season tamarind pulp (မင်းကျည်းမှုန့်), which acts as a cooling laxative, may also be added. A loaf from three to six pounds in weight, consisting of flour and other needful ingredients, which may be added in lesser proportion, may be given daily when much muscular exertion is demanded. Medicines are sometimes mixed up with the *ratibs* and *mussauls*. The best time to give *ratibs* is after some of the ordinary fodder has been consumed.

Aromatic spice balls known in India as *mussauls* (မဆာဆေးသီး) (see Part III, page 136) are also given occasionally. They consist of a variety of vegetable substances, many aromatic, such as—

Ginger (ချင်းစိမ်း),	Red pepper (ငရုပ်သီး),
Assafoetida (ပိန်းခွံ),	Black pepper (ငရုပ်ကောင်း),
Aniseed (ဝရမ်းပေါင်း),	Coriander (နံနံစေ့),
Turmeric (နီခွင်း),	Cardamoms (ပါလာစေ့),
Caraway seed (ကလေးစေ့),	Garlic (ကြက်သွန်ဖြူ),
Onions (ကြက်သွန်နီ),	Cloves (လေးညှင်း),
Mustard seed (မုန့်ညှင်းစေ့),	Nutmeg (ကဒိပိုက်),

and others. These *mussauls* are very useful in the hot season, being stimulant to the digestive organs thus promoting digestion. The ingredients are usually mixed with clarified butter (*ghi*, ഓടയോ: ഋ:യോ:യോ:യോ:), jaggery, or honey. Useful as these undoubtedly are where an indication exists, they should only be used sparingly. The long continued daily administration of these *mussauls* tends to blunt the sensitiveness of the digestive organs, creates new wants, and reduces the full natural reactive powers of the system. It is essential that they be given a liberal ration of salt, at least two to three ounces per diem. In fact a *ratib* may have to be given merely as a vehicle for the salt in order to establish the habit. Salt greatly assists the assimilative powers and, moreover, is most useful in helping to free the intestines from parasites to which elephants are very subject. Wild elephants in common with other wild animals are frequent visitors to salt-licks, where they eat the earth which is impregnated with natron.

As noted further on, petty peculation and appropriation of a portion of the *ratib* allowed by owners is a crime common to most elephant attendants and is, when the *ratib* cannot be given in the presence of a trusted person, one of the great drawbacks to allowing such extra food.

TIMES OF FEEDING.

With regard to the time of feeding, elephants should be allowed to feed at all times except when at work. If ample fresh fodder be brought in morning and evening and the animal is left alone, then of the twenty-four hours all but four to six will be devoted to munching. When continuous exertion of any kind is demanded, before and after work are the most appropriate times for supplying fresh fodder.

I have repeatedly observed yard elephants after work waiting for an hour or two for their food. This is a malpractice which cannot be known to employers, for they could not countenance a practice so cruel and one so likely to be damaging to their own interests.

The Commissariat scale of rations for elephants in Bengal, Madras and Burma is given in Appendix 39, Volume 5, paragraph 1917, Commissariat Transport, and is as follows:—

(1) Elephants when not on the line of march will be allowed two ounces of salt and one ounce of oil each. The following are the scales of green or dry fodder, as the case may be,

provided that the latter does not consist of straw alone, *i.e.*, without grain in it :—

	Fodder.	
	Green.*	Dry.
	lbs.	lbs.
Large elephants, <i>i.e.</i> , those over $8\frac{1}{2}$ feet in height	650	330
Medium-sized, those between $7\frac{1}{2}$ and $8\frac{1}{2}$ feet ...	575	290
Small elephants, those below $7\frac{1}{2}$ feet ...	500	250

* Sugarcane, green wheat, etc.

(2) When plantain stems, branches of trees, or jungle grass is given, the fodder allowance will be regulated as follows :—

When such fodder is procurable free of charge.			When it has to be paid for.
		lbs.	The quantities are not to exceed in value the cost of sugarcane ration calculated at the price current rate.
Large elephants ...	...	1,300	
Medium-sized elephants ...	...	1,150	
Small elephants ...	...	1,000	

(3) The dry fodder is to be issued only when green fodder is not obtainable.

(4) The following is the daily scale of rations for elephants on command :—

On command.	Grain.	Dry.	Green.	Bhusa.	Salt.	Oil.
	lbs.	lbs.	lbs.	lbs.	oz.	oz.
Large elephants ...	15	200	480	...	2	1
Medium-sized elephants	15	175	400	...	2	1
Small elephants ...	15	150	320	...	2	1

(5) Elephant attendants will get a special allowance of four annas a day when fodder is to be cut by them, and is provided free of charge. The allowance is admissible when animals are at graze.

(6) Commissariat Transport Officers are authorized to refuse to draw the allowance of four annas per diem for attendants if their elephants are not kept in good condition.

(7) When the cost of the fodder ration for elephants in Cantonments exceeds that of the command scale of rations, elephants in Cantonments should be fed on the latter scale.

(8) The rules in the preceding paragraph do not apply to elephants with heavy batteries, which are allowed rations on the scale (Appendix 38, paragraph 1917).

Appendix 38, paragraph 1917, gives the scale of rations as follows :—

Cattle.	IN CANTONMENT.						ON COMMAND.		AT GRAZE.	
	Grain.	Fodder.		Bhusa.	Salt.	Oil.	Grain.	Fodder, Oil and Salt.	Grain.	Oil and Salt.
		Dry.	Green.							
Elephants—	lbs.	lbs.	lbs.		oz.	oz.	lbs.	lbs.	lbs.	
First class ...	*15	200	480	...	2	1	15	...	15	...
Second class ...	*15	150	320	...	2	1	15	...	15	...

* Atta or Rice.

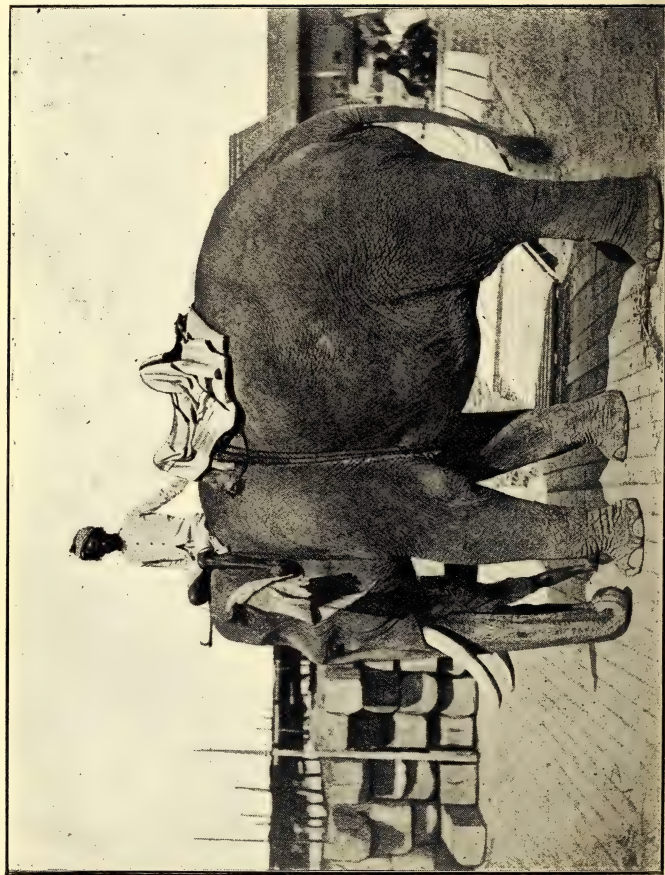
When *dhan* or paddy is given to elephants in lieu of rice or flour, the allowance is to be doubled. When paddy or rice is issued, 10 lbs. of grass is allowed per elephant per diem for tying up the grain in small bundles to prevent waste.

As already pointed out, this system of regulating an elephant's food requirements, at least to the elephant as shown in the above tables, cannot be satisfactory, as small thick-set animals often require as much food, if not more, than those of greater stature.

WATERING.

If an elephant be bathed morning and evening, and the water be good, he will generally drink the chief portion he requires on those occasions, which amounts to from thirteen to eighteen gallons at a time. If the water available at the bathing place be stagnant, he should be given drinking water from a better source beforehand, or be washed outside. Spring or well water is the best. Many

PLATE II.



A WELL-KNOWN ELEPHANT IN MESSRS. MACGREGOR'S YARD, RANGOON.

ailments are traceable to the use of bad water. Elephants like running water, and prefer to drink the water of tributary streams to that of the large rivers. At all times the water offered should be as sweet and clean as can be procured, though they are not averse to drinking muddy water (wild ones have little else during the rainy season). During the dry season good water-holes (such as the Burmans dig for their own use) should be dug in the sandy beds of streams; failing these, well water must be given. On no account are they to be permitted to drink from the tanks and pools used by cattle. In their natural state they drink shortly after sunrise and before sunset. Domestic animals ought to be watered at least twice daily, three times when possible, namely, morning, midday and evening. They should be watered about three-quarters of an hour before they are fed. On the march if any animal attempts to drink, although he be heated, he may be allowed to do so (this does not apply to squirting water over the body). A lengthened hot march (over seven hours) should not be attempted unless water is procurable on the way. When travelling with elephants during the hot season, marches should be regulated in accordance with the prospects of good water-supply.

WORK AND EXERCISE.

It is difficult to lay down fixed rules as to the amount of work which may be exacted. This must necessarily depend in some measure upon individual idiosyncrasies and constitution, which can only be ascertained by the careful observation of those in attendance (supervisors, etc.). What would undoubtedly prove moderate work in one individual might prove excessive in another, though to all appearances of equal size, age and condition. Again, the early symptoms of failing vigour which should be recognized by the mahouts are either not reported by them, or often after having been reported are paid no heed to by those in authority. I can call to mind instances in which an animal palpably suffering pain and going lame was found working. Regrettable as it is, the sufferings of an animal that may have toiled for years in his master's cause and contributed materially to his fortunes are passed unnoticed. Too often therefore it happens that an animal's energies are overtaxed to such an extent that he suddenly breaks down. So far as one can frame rules, I would strongly recommend that during the hot weather, from 15th February to the breaking of the rains, no animals should be worked in the open after 10 A.M., and never before 3-30 P.M. Moreover they should never be worked more than

three hours at a stretch without being given half an hour's interval or rest in the shade, during which time the gear should be loosened, parts examined for galls, and a little water and some bundles of fodder presented. I consider it imperative for humanity's sake that employers should detail, whenever possible, a European assistant to frequently (at least three times a week) inspect and report upon the health of the animals, their physical capability for work, also the sanitary condition of their surroundings, and above all the quality and amount *by weight* of fodder supplied.

When elephants are idle, it is essential that they have daily exercise, as they frequently fall out of condition from sheer want of it, especially so if under these circumstances *ratibs* be allowed. In some cases the daily journey for fodder will suffice. When however this is too short, and no work can be found, it will be necessary to give them a march for an hour or so in the early morning and the cool of the evening. In the hot season they should be rested between 10 A.M. and 4 P.M. It is cruel to work them in the heat, and is also dangerous, as they are liable to go down with sun-stroke. Where there is work, and in a great many instances there is more than the animals kept for it can properly accomplish, the following system may be tried. Assuming that the gear is a good fit, that the parts where it presses are healthy, and the animal in other respects in full health and vigour, it will as just mentioned be conducive to the maintenance of both that he should perform a daily task, be it marching, dragging, or pushing. An hour or so morning and evening of continuous exertion, such as the animal can compass without evident strain, is about what might be demanded without giving any extra diet. The question of the amount of additional work he can do will then resolve itself into that of how many hours taken from his legitimate occupation of munching green fodder can we make reparation for by offering a more generous diet. This is a clear issue and makes the answer easy. We can by these means assuredly not more than double or treble the duration of the working hours. The healthy elephant with good treatment, liberal allowance of fodder, can work regularly for six or seven hours a day without injury. But the question just answered is in practice rarely ever asked. The more common question which too, for reasons assignable, we are bound to answer, is not what are the limits of fair work, but what constitutes overwork, particularly in respect to carrying. In a campaign sometimes these rules cannot be adhered to, for conditions may arise demanding the utmost strain upon the elephant's capabilities. It is useful to know to what degree ordinarily the powers of the elephant may be taxed within twenty-four hours, without depriving ourselves of his services

for the next twenty-four hours or longer period. The reply is complicated, and can hardly be given in the form of any definite amount ; so many are the elements of each problem, so variable may these separate elements be upon one and the same occasion, as to make the laying down of rigid rules inadvisable. There are to be considered (1) the load ; (2) the configuration of the ground over which the road lies ; (3) the nature of its surface ; (4) the time of day ; (5) the existence or absence of shade ; (6) the number of days' rest enjoyed immediately before, and in prospect immediately after, the march ; (7) the quality and quantity of fodder and water available. From which collectively may be deduced the number of miles the animal can safely traverse. It must never be lost sight of that the elephant is a *nocturnal* animal ; therefore all work should as much as possible be done in the early morning and evening. It must also be borne in mind that in continuous exertion like marching, fatigue comes on almost imperceptibly ; we are then more likely to be deceived in measuring the staying power of the elephant than in work of a spasmodic and intermittent kind, such as dragging or pushing timber on the ground. If a log be too heavy, the animal will snort, refuse, or move it but a short way at a time ; but in carrying a load that at the first start off sits easily, the animal becomes exhausted almost unconsciously to himself. After a pause on the march he is unable to overcome the stiffness that immediately supervenes, and if he be goaded too much may drop down suddenly to rise no more. A good attendant will generally give timely notice of the possibility of such an occurrence.

The elephant is by conformation a beast of burden, and though he goes in draught he is out of place in it, as it throws him into an unnatural position, and he loses much of the advantage his size, weight and strength give him. [Elephants are employed for draught in the heavy siege batteries. Opinions vary as to the absolute weight an animal can carry. Of course the greatest weight he can sustain can be moved over short distances only, and medium loads over less space than light ones. Under some circumstances it is as much as an elephant can do to move the weight of his own body, not to speak of a heavy load, or a log of timber.

The Government loads vary from 1,000 to 1,200 lbs., but 1,000 lbs. including everything is a good load, and if elephants are to be worked for any time, it is inadvisable to make them carry even so much.

As regards dragging in the hills, if about three hours in the morning and three in the evening, and not more, be devoted to work, it will doubtless occur that the number of logs worked out in a season will fall below the average. Figures quoted with reference to this

heading can have but little general application ; local circumstances, such as the configuration of the ground, the distribution of the logs, and of the floating streams, will decide. A few facts may nevertheless be interesting. Two hundred logs, say two hundred and fifty tons per animal, dragged *ex situ* to the floating streams in the course of the season, may be regarded as an exceptionally favourable figure. It could not be accomplished except in a district newly opened up, where dead trees were still standing in considerable numbers in proximity to the streams. But taking Burma jungles in their ordinary form, an elephant might have to drag the logs some miles to the streams, and would probably die before he collected half that amount. In some cases the hill streams are fit for floating timber, and the work is about a third less than in others where a second land journey has to be made from the confines of the hills through the plain to the point where the stream becomes suitable for floating. The principal and the most trying part of the dragging work, namely, that of the isolated trees from their original sites up and down hill to the preliminary depôts, should be undertaken in the cold-weather months when the deepest leaf covering is on the ground, which, moistened by heavy dews, allows the logs to slide more easily.

A small dragging cart (Fig. 2) has been employed with profit even in the hills, and there is little doubt that by bringing thought to bear on improving such appliances and placing less reliance on sheer brute force, elephant labour might be economized (*see* Figs. 3 and 4) both in regard to the number of animals needed and the strain placed upon the powers of each.

Before and after work it is necessary to inspect all parts liable to gall, and if the animal has been carrying a load the attendant should shampoo the back with his feet and hands. The trunk and feet should be carefully examined for cuts, bruises, and foreign bodies, such as thorns, bamboo spikes, and during the rains the body for leeches, which are very plentiful in some parts of the Province and the bites from which at times cause nasty sores.

POWER OF ENDURANCE.

Though such large animals, their power of endurance is much less than is generally supposed, as they are constitutionally delicate. Through lack of appreciation of this fact, these animals have not received the attention they justly deserve ; and owing to the popular impression that they are extremely strong, the error obtaining in this respect has led to their being too highly tasked, and much of the

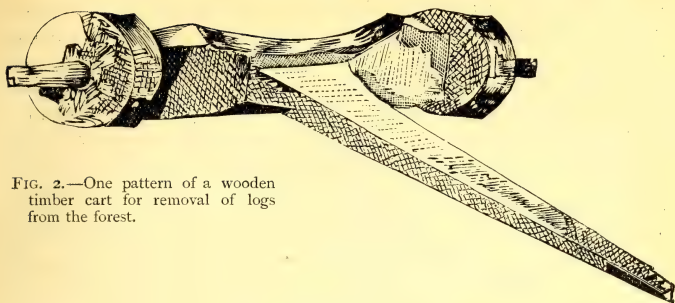


FIG. 2.—One pattern of a wooden timber cart for removal of logs from the forest.

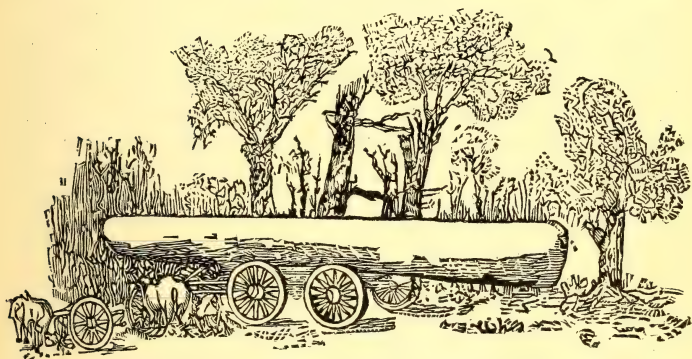


FIG. 3.—Four-wheeled cart for transporting timber.

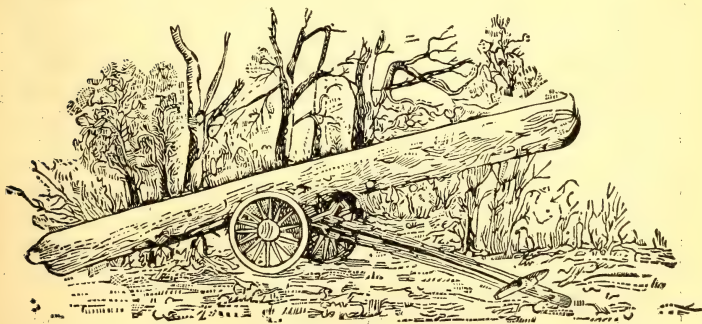


FIG. 4.—Two-wheeled cart for transporting timber.

ill-health and mortality prevalent amongst them may in a great measure be attributed to this cause. The smaller kinds of animals employed for transport are born and bred in captivity, and have thus by custom, training and other causes become more or less inured to hardships, but with elephants the case is entirely different; here, we have animals that have lived a natural life for many years, when one day (unfortunately for themselves) they are surrounded in their native haunts and captured. Soon after capture they are trained, put to work, frequently overworked, often neglected, and altogether submitted to conditions in every way foreign to their nature and well-being. It should not be a matter of surprise that the mortality runs high. Therefore it cannot be too forcibly impressed on the persons entrusted with their care, that untiring and vigilant supervision over the attendants, not merely giving orders but seeing them carried out whenever circumstances permit, is the means above all others for the proper preservation of the efficiency of the animals; they must remember that the class of men usually attending the elephants, if left to themselves, are from general indolence, carelessness, or from a desire to avoid the fatigue and hardships of jungle-life, or a campaign, quite liable to render their elephants unserviceable; ample supervision and systematic checks can alone prevent malpractices. A little neglect will often deprive an owner or a force of the valuable services of many animals.

As regards elephants employed in forest operations in Burma, the life of the elephant is frequently the only security capitalists have against advances made for timber to be worked through their aid. The percentage of deaths that annually occur amongst elephants employed in this branch of industry is probably from 10 to 20 per cent. Not an inconsiderable number of such deaths are due to over-exertion and exposure, and ignorance on the part of native owners as to the powers of endurance of an animal and their inability to detect the first symptoms of exhaustion; while in many instances they attempt to exact from a poor beast the last effort of strength it is capable of exerting. With reference to timber-dragging operations in Burma and Siam, the duration of daily employment naturally varies with the time of year, physical aspect of the country, and the food and water-supply. In timber-yards in Rangoon and Moulmein, where elephants are much exposed to the sun, they usually work from three to four hours in the morning and three hours in the afternoon. In forests, where the shade of the trees afford shelter from the direct rays of the sun, and where the country is not too hilly, or the drag too heavy, the hours of work generally extend from about seven or eight o'clock in the morning

till three o'clock in the afternoon during the working season, *i.e.*, from about the month of June to the middle or end of February. During the hot season the animals are allowed to rest, or at most they may be employed for a couple of hours in the morning in shady places and where good water and grazing are at hand, so that on being released from work they can be set free to eat to their heart's desire. In all such matters, however, it only requires common-sense and a little intelligent supervision to soon be in a position to ascertain the powers of endurance of each animal one may have to deal with, as these powers vary in individual elephants as much as in human beings, except that in the former case, when once an animal's strength is overtaxed, the evil is less readily remedied owing to the difficulty of treatment.

PACES.

The only pace of the elephant is a walk ; any increased pace he may put on is a fast shuffle. He can neither trot, canter, gallop nor jump. A ditch 6 ft. or 7 ft. wide and 6 ft. deep is impassable. A moderately loaded animal can, on a good road, travel three miles an hour.

REST AND SLEEP.

Rest extraordinary comes into question only before and after work extraordinary. Sleep in the case of the elephant is confined to a very few hours ; generally speaking from about 11 P.M. to 3 A.M., but often only for a couple of hours. It is of the utmost importance that the animal should have his sleep, such as it is, and this will be interfered with prejudicially if too frequent night marches or other night work be required, or if the feeding hours are too often curtailed by long continued work at any period of the day. To keep an animal waiting for his fodder on coming off work is already mentioned as one of the worst offences of which a mahout can be guilty, for by that means the animal's feeding time is wantonly subjected to further diminution, and the opportunity for sleep as well lessened in proportion. If the animal have not time to eat a sufficiency before midnight, it will continue eating all night, supposing that enough fodder has been provided. Care should be taken to see that the standing selected is on a slope, the ground even, free from stones, and that the elephant is allowed plenty of room.

EXPOSURE.

As already observed, the elephant is by nature a *nocturnal* animal, and is therefore most impatient of the sun. He appears to be more himself during the night, and in the mornings and evenings than during the day, even when protected by shade; at these times he is more active, and can in every way perform more work. Animals tethered in the sun will show their dislike to it by heaping bundles of fodder, blankets, in fact anything that will afford protection on to their heads, and constantly kick up sand which they collect and throw on their heads and backs. When working in the heat they frequently place the trunk in the mouth and squirt watery fluid over their bodies. Perhaps no elephants are exposed more to the sun and weather than those working in timber-yards, where they are at work from early morning till eleven o'clock and again from 1 or 2 P.M. to 5 P.M. The work however varies, sometimes light, at others heavy; occasionally they get a rest, owing either to there being no work, or to some part of the mill machinery having given away. It is possibly owing to the frequency of these rests, the variation of the work, and the extras in the way of food they receive, that they stand it longer than might be expected; but on the whole the mortality is high. If the animals are picketed out during the hot season, when the glare is very great, it is advisable to hang moist cloths or shades over the eyes. It is also desirable that elephants working in the sun be provided with a pad of material similar to the guddela, or of a lighter material, say cotton large enough to cover the neck and head and hang down a span or two around the latter. A careful attendant will often be seen spreading his turban or jacket over his animal's head to shield it from the sun. Exposure to rain and even having to dispense with other shelter than that of a tree, provided the drainage be good, does not seem to act prejudicially. On the other hand, exposure to cold night winds in open sheds erected upon bare, unsheltered and elevated sites, which again become heated to a proportionate degree during the day, has been justly regarded as a source of disease. Artificial shelter is required only where good natural shelter fails. The best shelter is a grove of evergreen trees standing on a slight slope, where the drainage is good and so large as to permit of the standings being frequently changed. But for elephants working in yards, sheds have to be built. They should be erected on sheltered and well-drained sites, and ought to be provided with jhamps on the north-east and south-west sides, and have raised sloping floors of concrete or laterite. Floors made of slabs of wood are objectionable, unless well raised with a concrete

floor beneath which can be swept as well as flushed, otherwise urine, etc., runs down between the boards, thus saturating the soil beneath. Several short stout posts with or without ring-bolts should be planted firmly within and without for the purpose of tethering the animals. Quarters should also be provided for the attendants in connection with the sheds in order to remove any excuse for absence from their respective animals.

Elephants are often kept in stations without their presence being turned to good account, and where facilities not only for obtaining their natural fodder and for bathing but natural shelter also fail. Much sickness, mortality, as well as current outlay would be done away with were the elephant depôts to be moved to the nearest place which offered natural advantages for the keep of the animals. Some localities have been observed to be very badly suited for the keep of elephants, in which nevertheless their services are required for sorting timber, etc. Such places will generally be found to be of a kind varying to the furthest extent from the conditions in which we meet with elephants in their natural state. Perhaps none are more objectionable than the daily inundated tidal marsh lands, where the sheds are situated on patches of ground which barely escape inundation.

In selecting camping-grounds it is essential that the ground be sloping; the elephants should face with heads uphill, otherwise if they lie down they might experience much difficulty in rising; care should also be taken to see that the standings are not on uneven ground, and that they are free from stones and stumps.

All dung, litter, etc., should be removed morning and evening to a considerable distance from any standing.

BATHING AND GROOMING.

Bathing is one of the natural functions of the elephant, and most important to his health. In the wild state the animals pay daily visits to the deep cool pools in hill streams, and even the large rivers, and immerse their bodies, lashing the water about them, or squirting it over themselves. Inactive as the exhalatory functions of the skin appear to be, dirt speedily produces much irritation, and continued want of a bath general indisposition. It is of advantage that the water be deep enough to admit of immersion of the whole body in the crouching position, if not otherwise. They should on no account be kept in places where facilities for bathing fail. They may when in health be taken into the water in the early morning, as they appear to possess no sense of

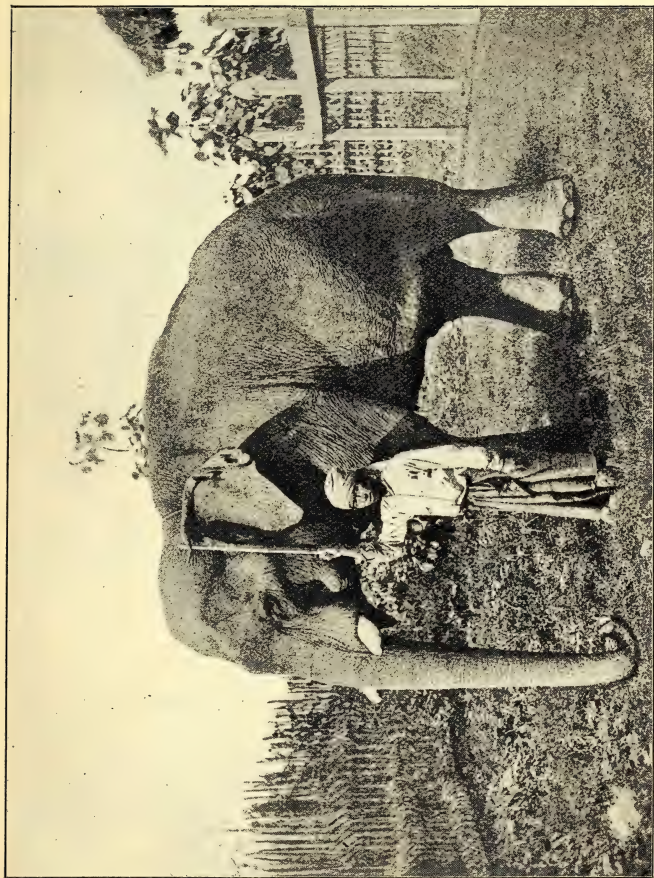
chilliness, for if left to themselves they will not hesitate to enter water shortly after daybreak. Sunset is the best hour for the evening bath. While bathing the attendants should rub the body over with a soft stone or the husk of a cocoanut; the animal will squirt water over himself constantly. The natural orifices and feet must be kept clean. When a halt has to be made at a place where no body of water exists, the attendants must draw water from wells and pour it over the animals. Bathing is never to be undertaken when animals are in a heated condition. If a river is encountered on the march, they should be halted and not permitted to enter till their bodies have cooled. When dry after bathing, it is customary for the attendants to smear oil all over the upper portion of the head, the idea being that it has a very cooling effect and soothes the irritation with which the scurfy state of the head is so commonly attended. If this part was kept thoroughly clean and protected from the sun by a pad, this remedial anointing might perhaps be dispensed with. It must be remembered that the application of oil deepens the colour of the skin to a perfect black, thus vastly increasing the capability of the surface for absorption of heat. If a sun pad is necessary under ordinary conditions, it would appear to be doubly so after oiling.

ATTENDANTS AND THEIR DUTIES.

Every domesticated elephant necessarily has its own particular attendant, *oo-si* (ဦးမီး, the man who rides in front) or mahout. In the case of Government animals and those of some private owners, the *oo-si* is allowed an assistant, known as the *pai-si* (ပိုမီး, the man who rides behind). In India he is called *cowardie*. The *oo-si* either is directly under the control of his employer, or, where there are a number of animals, indirectly through an overseer, *sin-ôk* (ဆင်အုပ်), *singaung*, sometimes called *kyun-ôk* or *jemadar*. The duties of an *oo-si* are the continual immediate care of his elephant, both on and off work. In the former case, he rides on the neck of the elephant, guides it on the march or directs it in dragging, pushing of timber, etc., and it is at all times his duty to be on the alert for means of economizing the strength of the animal, saving it unnecessary exertion and exposure. Off work it should be his first care to see that the animal receives its drinking water, bath, and a sufficiency of good clean fodder; also to see that it is kept in the shade, or in a shed, his personal convenience being secondary. He must wash and examine every part of the body daily, notice any departure from the normal state as

PLATE III.

[Facing page 34.



THIS ELEPHANT WAS PROBABLY ONE OF THE BEST-TRAINED ANIMALS IN BURMA. Photographed when aged; hence prominence of spinal ridge and worn condition of tusks. He shows all the good points of elephant in Plate I. Height about 8 feet.

regards appetite, evacuations, external temperature of the body, and report the same without delay. If the animal is turned loose after work, he must after careful inspection of the body take him to where the grazing is good, see that the drinking water is clean and near at hand, and also take care to fetter the elephant carefully and securely to prevent straying, fighting, etc. He should in the very early morning follow up his elephant and note how the night has been spent. It is important in addition to signs of feeding, amount and condition of the evacuations, to note how often the animal has slept. One "bed" is usual; two or more or the absence of any "bed" at all is an indication of something being amiss, as also if the animal has been known to sleep during the day. He is responsible for the proper adjustment of the harness and arrangement of loads, also that no long-continued undue pressure takes place upon any part; he must be on the look-out and report the first symptoms of fatigue, whether arising from exposure, overwork, overloading, or from failing health. The *oo-si* should have experience of the most approved methods of fettering, catching, subduing, and approaching unruly animals. He should administer all medicines directed to be given, but should not on any pretence whatever be permitted to prescribe or give any drug unless specially authorized to do so.

The *pai-si* has to attend to the instructions of the *oo-si* and assist him in such manner as may be desired. He is generally employed on cooly work, *i.e.*, collecting fodder, keeping the standings clean. On the march it is his duty to precede the elephant to explore the route, with a view to the avoidance of quagmires and quicksands, as well as of sharp stumps or stones. This important duty is however frequently not carried out efficiently owing to laziness, the *pai-si* riding on the elephant. In the case of timber-working elephants, it is the duty of the *pai-si* to fix the dragging chain on to the logs, and he is then frequently called the *pai-chaik* (ပုခိုက်), or the man who "hooks behind." It is in the capacity of *pai-sis* that *oo-sis* serve their apprenticeship. The *sin-ôk* or jemadar, when one is kept, controls the *oo-sis* in the duties above detailed; he should possess superior experience and judgment in the recognition of the more ordinary ailments, also a knowledge of the uses of some of the common drugs, as well as ability to dress wounds, etc., and perform minor operations such as opening abscesses. All who are directly connected with the care of elephants should be firm, kind, and above all even-tempered, qualities for which they have a ready perception. I have known the training of a previously well-behaved animal to be lost to such a degree that she would endure neither load nor rider, simply owing to the accident of being placed in the

charge of an irascible fitful keeper, who first negligently indulged, and then wantonly punished her. A rider who ordinarily shouts



FIG. 5.—Driving hook made entirely of iron.

out his words of command in a needlessly harsh and loud voice, and who extensively and passionately employs the goad (see Fig. 5), is usually of this class. In timber working many elephants are ruined in this way; hence the danger in changing drivers. The essence of good riding consists in controlling the animal entirely by word of command, and the proper application of the knees and feet when necessary. There is a word in Burmese which describes a good driver as a "knee rider." Elephant-keepers are a peculiar class of men, who require delicate handling, but with a little tact much good can be got out of them.

Elephant driving is an art which takes some

learning; good men know their value, so must be pampered a little; they are well aware of the fact that most Europeans are ignorant as regards elephants and their management, and are consequently very often a little above themselves. One point in connection with elephants must never be lost sight of, namely, the importance of securing a maximum degree of permanency of the particular attendant of a particular animal. A keeper who is possessed even in a moderate degree of the qualifications already enumerated, and who has been with his elephant a sufficiently long time to have studied the peculiarities of his charge, has become invaluable to his employer. The knowledge in question can only be gained by experience, and lengthened individual observation; it cannot be placed on record or otherwise handed down; hence any animal placed in the hands of a succession of keepers is subjected to treatment extremely calculated to prove prejudicial to its health, temper, and utility. Much ill success in the maintenance of elephant establishments is to a great extent traceable to this cause; accordingly it will be found expedient to condone much in a good keeper.

The common offence for which mahouts are dismissed is the appropriation to their own use, or sale for their own benefit, of the *ratibs* (special allowances, such as flour, rice) allowed by their employers. The best remedy for this is extra supervision and whenever practicable to make certain of the animals receiving their full daily allowance by having them fed in the presence of some trusted person. If this cannot be done, flagrant as is dishonesty of this kind, a really good keeper should not be dismissed,

unless his peculation is of such a degree as to affect the health of the animal in his charge, thus evincing a lack of concern in its well-being. Petty peculation, submission of false and exorbitant bills for medicines said to have been purchased and given in emergency, and regularly stealing a portion of the *ratibs*, are drawbacks which in an elephant establishment must be regarded as lesser evils. Elephant attendants appear to be unable to abstain from these methods of defrauding their employers, and any attempt to enforce honesty by severe measures would eventually be visited upon the animals, and thus a much greater evil brought about than that which it was sought to avoid. Supervision will ensure the animals receiving the food ordered for them, and by keeping a supply of ordinary drugs and *mussaul* ingredients, the attendants would soon recognize that it was quite unnecessary for them to submit bills for medicine.

As a rule a driver is proud of his elephant, and it is astonishing to see what a good man can make his animal do; all his orders are given in a quiet persuasive manner, and his hints (conveyed by his knees and feet behind the animal's ears) are given in such a quiet way as to make it almost appear that the movements of the elephant are spontaneous.

There are many offences for which keepers should be severely punished or dismissed, namely, a man who takes no pride in his animal, and shows no concern about its prosperity, evinced by making the immediate wants of the animal subordinate to his own, by cooking his food, sitting down to smoke before he has watered and fed his elephant, neglecting to bathe it when proper opportunity offered, taking the animal into water when the body is heated, overworking or overloading it, tying it up at nightfall instead of allowing it to graze so as to save bother in tracking it up the next morning, failing to administer medicines ordered, and neglecting to report any symptoms of ill-health, injuries, etc.

Nevertheless, keepers of almost tantamount value with their animals and to their employers are frequently dismissed or discouraged for offences which by comparison with the above are mere bagatelles; often too upon charges not thoroughly enquired into or proved. Much care as may be exercised in the choice of a good keeper, it is singular how little is occasionally bestowed on that of the disposition and attainments of the person empowered to deal summarily with him.

As a matter of fact in a great many instances the occupation of the care and treatment of elephants as *oo-si* or mahout runs in families for generations, the father training his son to a knowledge of the work.

In this Province, when elephants are purchased, they are generally in the care of Burman, Karen, or Shan drivers. There is little doubt that in regard to the handling and general management of domestic elephants, they are rarely as good as the Indian mahout as seen in India, but they are in every respect better than the majority of so-called mahouts met with here, who are readily discerned to be adventurers as far as their pretensions to any previous knowledge or experience of elephants goes. The few Indians employed are generally on Government animals, or those working in yards. There are many excellent keepers amongst the Burmans and Karens; many however are careless and lazy, and a few are impatient and at times cruel. As a general rule they are kind, can stand the climate and heavy jungle work, and are usually cheery willing fellows.

The pay of a *sin-ók* or jemadar ranges, according to qualifications, from Rs. 20 to Rs. 40 per mensem; the pay of an *oo-si* or mahout, from Rs. 12 to Rs. 18 per mensem; the pay of a *pai-si* or cowardie, from Rs. 10 to Rs. 12 per mensem.

Burman employers usually supply their men with food and in addition give them a few rupees monthly.

It is a good plan to give a good mahout a bonus at the end of the year, but I think it would be preferable to give such men a small increase of pay. Increments of pay are thought much more of by these people.

CHAPTER III.

HYGIENE :—GEAR FOR DRAGGING. PACK-GEAR. CARE OF GEAR.
SUMMARY OF GENERAL HYGIENE.

GEAR FOR DRAGGING.

For timber-dragging, the harness in most general use consists of numdah, saddle, girths, back sling, and chains, and to describe them in order we will take first the numdah :—

This consists usually of the dressed bark of the *bambwè* tree ဗမ်ဗွေခေါင် (*Careya arborea*) in pads of about 3 ft. by 4 ft. in size. The bark is stripped from the tree in one piece, and prepared for use by beating it with some heavy instrument sufficiently to loosen the fibre, without shredding it altogether as with coir. If properly prepared, a piece of *bambwè* so treated is made as soft and pliable as jute, and very seldom causes a chafe. The bark itself has also astringent properties, which are cooling and hardening to the skin on which it is directly laid. There are other barks used, namely, *shaw* ချောင့် (*Sterculia ornata, versicolor and villosa*), all prepared in much the same way ; but the first mentioned is more generally used. Over the bark is spread a green hide or two, on which are placed the *ohn-dones*.

Saddles or ohn-dones (အုန်းခင်း), (see Fig. 6).—These are pieces of any light wood, about 18 ins. by 4 ins. by 4 ins., hollowed out roughly to decrease the weight. They are connected by ties (12 ins. to 18 ins.) and of sufficient length to allow them to rest on each side of the spine, and high enough to remove pressure from the back-bone itself, when the slings are in place.

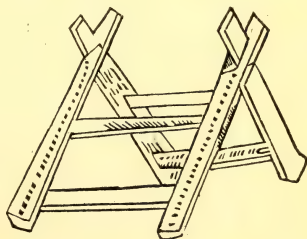


FIG. 6.—Elephant dragging saddle in present use.

Another variety of saddle in common use, called a

kwechee (ကွေ့ချီး), is a light frame-work, and it appears to be a matter of opinion, not unmixed with a good deal of feeling, with the workers of elephants as to which kind of saddle is the more comfortable for the animal.

Girths and sling.—The *ohn-dones* being in place are girthed on with a belly-band of woven *shaw* about 2 ins. broad and 15 ft. in length; the sling or *gók-see* (ဂုတ်စည်း) is next adjusted. This too is made of *shaw*-rope about $2\frac{1}{2}$ ins. in circumference, and is of such a length that when doubled and laid over the back the two loops hang down the shoulders to a height rather above the level of the chest. Through these loops the ends of the breast-straps are passed; and as the use of the *gók-see* is mainly to keep the strap in position on the breast without any undue downward strain on the spine, it requires more or less adjustment for each elephant. Its “hang” should be adjusted so as to bring the chains and breast strap, when taut, in one straight line off the muscles of the chest, quite clear of the throat and not too low to cramp the free action of the legs.

The *breast-strap*, which after the chain is the most important part of the harness, is made of finely shredded *shaw* twisted up in two strands each about the diameter of an ordinary walking-stick, and woven on a rough loom. The strap is about 5 ins. in breadth, and finished off at each end in a loop, into which iron eyelets are fitted. The length varies for different elephants; it should be just sufficiently long to go round the chest and pass through the loops of the *gók-see* clear of the shoulders, so that the chain when hooked on and in use does not interfere with the free action of the shoulders. The breast-strap before use is softened with fat; and as the elephant's breast is well greased before work the strap soon absorbs enough fat to make it soft and pliable. This strap however, even with care, only lasts from three weeks to a month. The mahouts make the breast-straps for their animals, and usually keep a fair stock.

Chains.—For tuskers $\frac{3}{8}$ -in. and for females $\frac{1}{2}$ -in. rubble chain is generally used. The chains are fastened to the breast-straps by means of large hooks, or by a swivel-link, locked across the loop of the breast-strap. In the former case care is to be taken that the chain is not twisted before hooking up, otherwise the rotary motion

of the twisted chain will chafe the animal's side and may even dig the big hook into its shoulder. The chain consists of two traces, one 14 ft. long, and the other 8 ft. (to take an average measurement), but it is best to determine the length of chain most suitable to its build after examining the animal at work. At the working end of the longer chain is a link sufficiently small to pass through the drag-hole of the log and hook on to the short trace, which is fitted with a strong stub-hook. It not infrequently happens that even the larger-sized chains part under a heavy pull, and accidents though frequent are not as one might suppose serious. It is rarely that any injury beyond an abrasion results to the elephant. The driver is provided with a strap from the saddle with which to hold on at critical moments.

The foregoing is sufficient harness for an ordinary well-trained elephant, but it is occasionally necessary to supplement the gear with backing chains and a crupper made of plaited cane for animals given to jibbing and other tricks (see Fig. 6A).

Description. — A—A *ohn-done* (saddle), C—C saddle pad. A belly band of strong rope or chain (E) girthed *tight*. To this attach the sling B, passing same *tight* under the animal's tail. Through this weave the sling D (which may be either of rope or chain) over the root of the tail and under the sling B. Pass the dragging chains F—F through the loops of D at G—G, and the animal cannot then ordinarily get out of his harness. For the sling D a pair of fetters will often be found long enough. The shorter this sling the better, especially for a wicked animal.

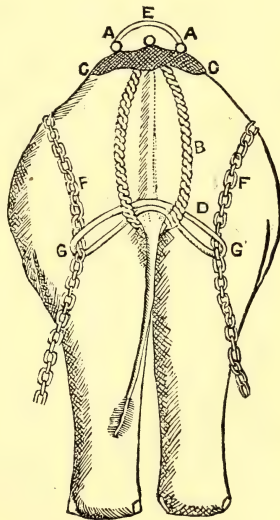


FIG. 6A.—Backing gear.

Other articles of elephant's equipment are fetters, *soolay*, and foot-chain. The latter two are seldom used, except on runaway beasts and confirmed bolters; they are only removed to be changed occasionally from one fore-foot to another. The foot-chain alone is used in dry country, when the mahout would have difficulty in picking up his elephant's tracks, and for animals given to wandering or straying. In such cases 40 ft. of $\frac{3}{8}$ -in. chain is tied to the fetter between the fore-legs, and allowed to trail.

PACK-GEAR.

This is a most important subject and cannot receive too careful attention. Unless the gear fits properly and is carefully adjusted, galls are likely to result and thus incapacitate animals often for lengthened periods. This may be a matter of the utmost importance, for instance when such animals are employed for transport in warfare.

Different patterns have been devised from time to time, but there is only one which can be recommended, and that is what is known as "Sanderson's improved pattern," and which is the pattern adopted by Government. The subject of gear has been ably and fully treated of in a Government pamphlet, edited by this well-known authority on all matters concerning the elephant, entitled "Pack-gear for Elephants," published by the Superintendent, Government Printing, Calcutta, and which I would advise anyone employing Sanderson's gear to obtain. The following remarks are chiefly quoted from this work:—

The gear consists of the following parts:—

				lbs.
Guddela	...	...	...	45
Guddee	...	...	...	100
Iron saddle	...	...	...	60
Girth complete	...	...	...	20
Neck-rope	...	...	...	4
Crupper-rope	...	...	...	2
Iron pipe crupper	...	...	...	5
Total				236

- (a) The *guddela* is a pad usually made up of layers of soft numdah sewn together and covered with cloth, and is placed next to the body to protect it from abrasion, and is about 4 ins. in thickness.

- (b) The *guddee* (Fig. 7) is a reed-stuffed pad, placed on the *guddela*, and is furnished with a longitudinal opening to receive the spine and protect it from pressure and friction.

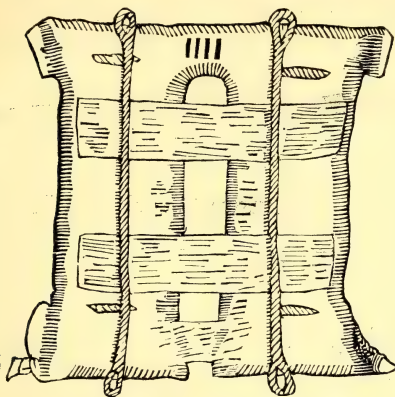
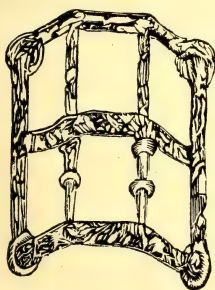
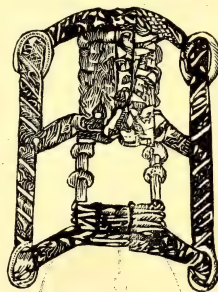


FIG. 7.—Sanderson's pattern guddee.

- (c) The *iron saddle* (Fig. 8), which may or may not be employed, according to the nature of the load.



Plain.



Wrapped for use.

FIG. 8.—Saddle for elephants (Sanderson).

- (d) The *girth* is a stout woven belt of tarred seizing-line, and a light chain for re-tightening. To the D of the girth a cord is attached, which is passed through a pulley shackle at the top of the chain, by which the girth

can be hauled up when slack ; the D is then hooked into any required link of the chain ; a short rope attached to the top ring connects the girth with the bobbins of the saddle. Tight-girthing is essential to prevent the gear from slipping and the load from swaying.

(e) *Neck-rope* (Fig. 9) is furnished with a loop at one end

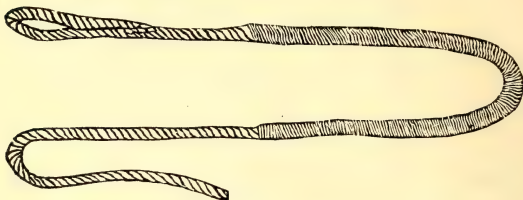


FIG. 9.—Sanderson's pattern neck-rope.

and is partly covered with leather which I think should be under-sewn, not over-sewn, as usually is the case. This rope affords fore and aft play of the load.

(f) The *crupper-rope* (Fig. 10) is also furnished with a loop

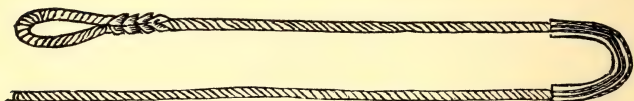


FIG. 10.—Sanderson's pattern crupper-rope.

at one end ; both of these ropes are secured to rings on the saddle or tags on the guddee, and can be re-tightened as required.

(g) The *crupper* (Fig. 11) is a U-shaped piece of iron pipe through which the crupper-rope is passed.

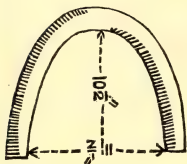


FIG. 11.—Iron pipe-crupper (Sanderson).

(h) Loading rope, 80 ft. long.

I would urge that all gear be obtained as directed by Sanderson, as follows :—

Iron saddles and crupper pipes from the Alipore Jail, Calcutta.

Guddelas, guddees, neck and crupper-ropes from the Harness and

Saddlery Factory, Cawnpore. Girths from the Presidency Jail, Calcutta, as they have been manufactured at these places for some

time, and been found to fulfil all requirements. Moreover, I may add that they are constructed of such excellent material that their durability far exceeds any other that I am acquainted with.

The gear is made in six sizes to suit animals of different heights, and the guddee may be obtained stuffed or empty. Therefore it is only necessary to state vertical height at the shoulder when ordering it—

			Ft.	in.	to	Ft.	in.
I	...	...	9	0	to	9	5
II	...	...	8	6	to	8	11
III	...	...	8	0	to	8	5
IV	...	...	7	6	to	7	11
V	...	...	7	0	to	7	5
VI	...	...	6	6	to	6	11

Prices are as follows as obtainable in Calcutta :—

			Rs.	A.	P.
Guddela	...	...	23	7	1
Guddee, unstuffed	...	...	4	15	11
Iron saddle	...	...	18	8	0
Plaited girth with appliances	...	...	4	8	0
Neck-rope	...	...	0	11	0
Crupper-rope	...	...	0	6	0
One and a quarter inch iron crupper, 30 ins. long	...	...	1	8	0
Total	...	...	54	0	0

The guddee rope, lashings of girth, neck, and crupper-ropes require renewing annually.

A guddela lasts four years with two renewals of cloth.

Saddle, D's, pulley-chains, crupper, etc., will last ten years, and the girth-webbing three years.

This gear must be frequently inspected, that is at least twice a week ordinarily, and when on line of march, daily.

Guddela.—The chief points to attend to are the stitching of the covering-cloth and leather chafing-pieces.

Guddee.—If thoroughly stuffed, and a guddee cannot be too tightly stuffed, examine the underside for lumps and see that rope tags and cross bands are securely sewn on, and that the seams have not given way.

Saddle.—Wrapping of lower bars and netting between upper bars should be tight. The bolts at the end of pipes must be kept tight.

Girth.—If any fraying of the web of girth occurs, it should be stitched with twine. It must always be kept soft with some lubricant. Neck-rope may become loose and must be relaid.

Instructions for saddling.—The elephant having assumed a kneeling posture, the guddela and afterwards the guddee is placed

on the back. With many animals these have an inclination to move backwards and forwards so that the guddee works beyond the guddela and abrasions are thus likely to result. A careful mahout knows his animal's peculiarity and makes allowance for this when putting on the gear. Constant attention must be given on the march to see that they retain their relative positions.

Saddle.—The lower side-bars should be wrapped with soft rope to prevent chafing of the load and girth-ropes, and a network of rope should be woven between the upper bars to prevent small articles falling through.

It is placed on the guddee with the bobbin-end in front, and must occupy a medium position on the back.

Girth must be doubled and the centre marked off with chalk, which mark must be placed at the middle of the belly while adjusting. Correct the length of the webbing by holding chalk-mark in position. If correct it should allow the iron D's to clear the fore-limbs in action, but not to come so high that the pulleys may fall on to the guddee. If the webbing is too long or short correct accordingly; then hook the D's of the girth on to the lowest ring of the chains on each side. Tighten the girth so that the rings may come nearly home to the bobbins on the saddle, and see that the positions on different parts correspond on both sides.

Fasten one of the short ropes attached to the rings to the near or left side bobbin of saddle, carrying it two or three times between bobbin and ring and secure, leaving the ring about 9 ins. from the bobbin; lash up the other ring-rope, as on near side, to off or right side bobbin and ring and haul quite tight.

This is done by the mahout who stands on the guddee. Now loosen the near side ring-rope, pull the girth as tight as possible and make fast. If properly adjusted, both the rings should be nearly home to the bobbins, the pulleys clear of the guddee, and the girth throughout quite tight. Lashings may require to be slightly shortened in a few days when the gear settles.

To re-tighten girth on the march.—Pull it up equally and alternately on each side by the ropes attached to the D's and link higher into chains, then pull D rope under the hooks on D's and wrap round chains, or neck or crupper-ropes. The chains should invariably be put back to their bottom links at next starting.

Neck-rope.—Loop into one of the front corner rings of saddle, carry round neck, and with the elephant's head raised pull as tight as possible through the other ring, and knot.

Crupper-rope.—Pass through crupper pipe, secure into rear corner-ring of saddle like *neck-rope*; make very short when descending hills or the elephant's withers may be galled.

CARE OF GEAR.

Guddela must be dried after being wetted, by hanging it with its length parallel with ground. It should be rolled up at night to keep from damp and white-ants.

Guddee should always be lifted off, not thrown off, as is usually done, as this not only tends to shift the stuffing but strains the sewing. It should be stood on end till required. Girths, neck, and crupper-ropes should be placed where they cannot become wet or soiled.

If, as a matter of routine, each part of the gear is always kept in its appointed place near each animal, sets will not become mixed, and the attendants will know exactly where to lay hands on them at

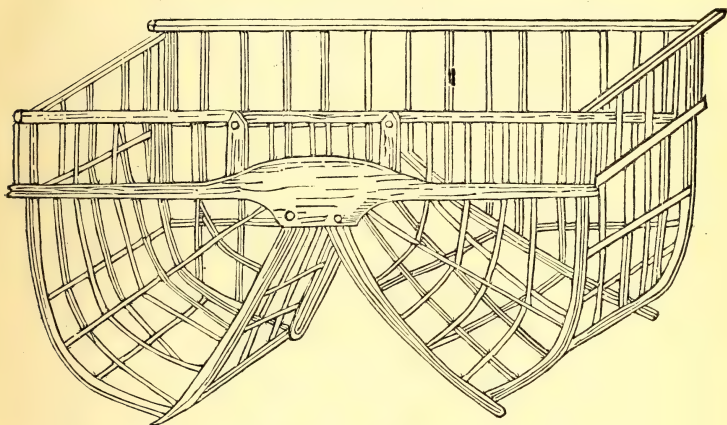


FIG. 12.—One form of howdah used in travelling by the Burmese and Shans.

a moment's notice. The excellence of this pattern gear, which is the result of many years' experience and labour on the part of the late G. P. Sanderson, I can fully testify to, but my experience in this country with ordinary mahouts has taught me to discard the iron saddle when working in hilly country, as I found it next to impossible to have the loads so secured as to prevent some backward and forward play. Another fault necessary to look out for and punish severely is the habit that some careless mahouts have of placing chains, etc., when not in use, on the spine, in the trough caused by the opening in the *guddee* after it is placed on the back, and which is purposely made to reduce weight and prevent friction on the spine. The Burmans, Shans, Karens employ baskets of various sizes

and pattern for carrying purposes (*see* Figs. 12 and 13). They are cheap and easily repaired, but quite unsuitable for military purposes.

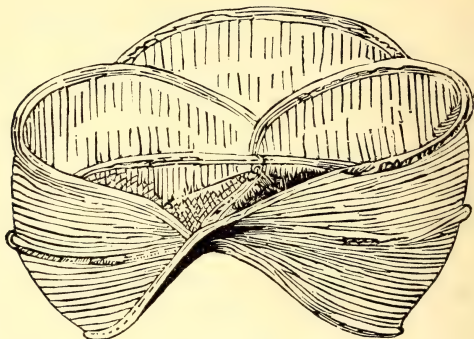


FIG. 13.—Karen howdah for carrying grain.

SUMMARY OF GENERAL HYGIENE.

To maintain elephants in health, the following points should be attended to:—

- (1) Regular but moderate work—never work them except in heavy shade during the heat of the day.
- (2) Careful loading—never over-load or keep an animal kneeling long to receive a load or standing under it longer than is absolutely necessary.
- (3) After working, pads should not be removed till the animal cools down.
- (4) Should any abrasion or gall be noticed, however slight, the animal should be thrown out of work until such is perfectly healed.
- (5) Early feeding, with an ample supply of fodder, should be insisted on in order to permit of proper rest.
- (6) Regular bathing with vigorous friction applied to the body.
- (7) Watered at least twice daily, after sunrise and before sunset.
- (8) Camping grounds should be on a slope, and care should be taken that they are kept in a thoroughly sanitary condition. During the hot weather elephants should be picketed in shady places, and during the rains sheltered as much as possible.
- (9) Particular attention to cleanliness and thorough repair of gear.

CHAPTER IV.

MOUNTING. RESTRAINT. FETTERING FOR GRAZING. SECURING FOR OPERATIONS. BOLTING. CROSSING RIVERS. QUICKSANDS. DESTRUCTION OF ELEPHANTS.

MOUNTING.

In order to mount an animal that is nervous of his keeper, which will sometimes happen if it be in dread of a wound being handled, or dressed, or other cause, a good plan is to throw a rope over the body making a running noose and haul it tight round the belly, whereby to climb up.

RESTRAINT.

For this purpose fetters, chains, and ropes are employed.

Fetters are of various patterns: those most commonly used consist of short lengths of chain. A fether is carried for each foot,



FIG. 14.—Chain hobbles for fore-legs.

the fore-fetters are connected by a short chain like hand-cuffs, and those for the hind-legs are also joined in a similar manner (*see* Fig. 14). The fetters are fastened by means of a special link-hook. Some elephants can undo this fastening; in such cases a peculiar spring lock of native pattern is applied to fasten the fether. Many foresters employ these locks when they let their animals free in the jungle to prevent their being stolen.

Fetters made of plaited cane are more often employed by the Karens. The fether is a simple hoop of plaited cane (*see* Fig. 15);

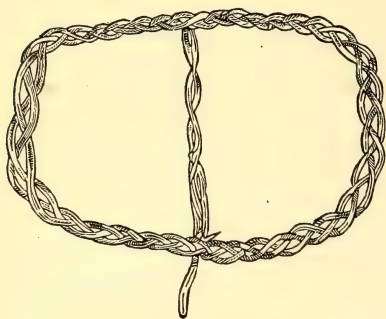


FIG. 15.—Fether for fore-legs, made of cane or strong creepers, used by the Karens.

when in position, it is lashed between the legs with a rope or thong.

Special fetters are sometimes used, such as the *soolays*; these consist of three pieces of iron, jointed and fitted with spikes on the inside; the hind-fether consists of two pieces of iron jointed and spiked; they are only used on unruly beasts, or when there is a chance of animals stampeding

through fear, or on those given to bolting (*see* Figs. 23 and 24).

Tethering chains are of variable lengths and thickness; they are usually fitted with a stout iron ring at one end (Fig. 16).

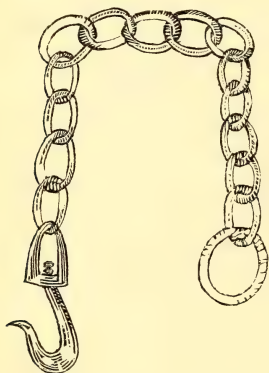


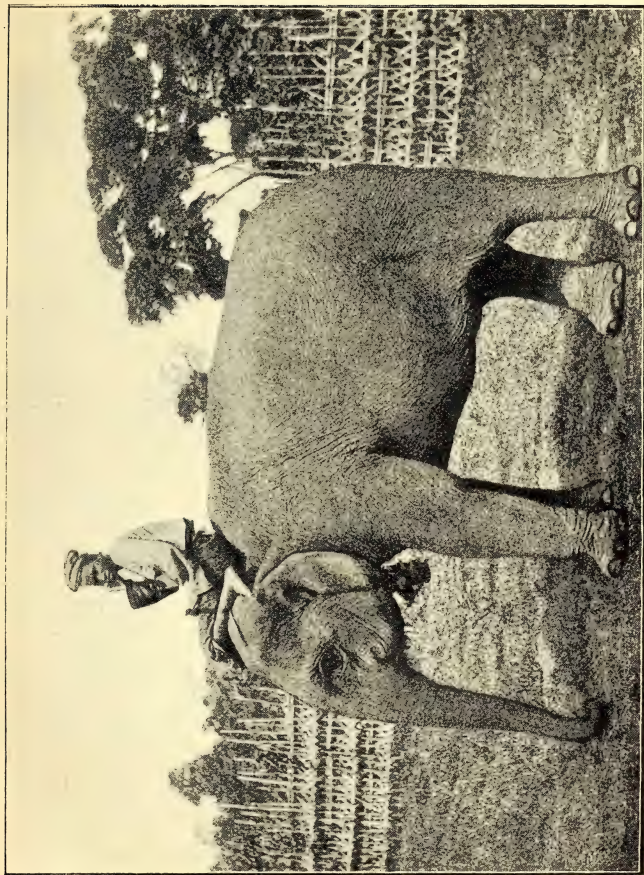
FIG. 16.—Tethering chain, about 12 ft. long, used for one hind-leg only.

Tethering. — Elephants are often secured by one fore-limb only; both fetters are passed through the ring of the tethering chain, after which they are applied to one of the fore-legs; this method allows the animal plenty of freedom. Where space does not permit, or when other elephants are near by, the hind-fetters are put on in a similar manner to the fore, and the tethering chain secured to a post or tree behind.

When *musth* is anticipated, extra precautions are taken; the fore-fetters are applied, one to each limb, and a tethering chain runs from each to a tree or post: so with the hind-legs; and in

animals known to be vicious when *musth*, for extra security they often have their fore-legs brought close together, and a long rope is then passed round the limbs above the fetters in a figure of 8, and secured between the limbs. Sometimes only one hind-leg

PLATE IV.



FINE SPECIMEN OF A COW ELEPHANT.

is secured, in which case a rope is wound round the leg about half-way up and tied; the tethering chain is applied above this. For animals given to trying to throw the mahouts off, an iron spiked chain collar is sometimes employed.

FETTERING FOR GRAZING.

When elephants are set free to graze during the day or night, care should be taken to have each animal properly fettered, more particularly the males, as it not only prevents them wandering away for miles, but may interfere with the males fighting, as they are apt to do at times, goring each other seriously. An unfettered small male has a great advantage over a much larger fettered opponent; and cases have occurred of elephants dying from the effects of such conflicts. In the case of a fight between two elephants belonging to different owners, one being fettered, the other free, the owner of the former received a decree in Court for all the damage done to his animal by the unfettered one. The degree of injury done by goring depends naturally on the length, thickness and sharpness of the tusks. Sharp tusks will readily pierce the tissues inflicting terrible wounds; but blunt ones, whether from pushing timber, or from being intentionally cut, will in many cases cause contusions only, the effects of which, however, may be of a very serious nature. A case recently tried in Upper Burma will prove of interest to owners of elephants. I therefore give it in full from the "Burma Law Reports," Volume VII, Part II, page 73, 1901 (*see* Appendix A).

SECURING FOR OPERATIONS.

As a rule elephants are very good about being operated on; they do not appear to mind being cut; there are however many troublesome dangerous beasts who require to be carefully secured.

The two more common methods employed are as follows:—

- (a) The mahout should bring the animal up to a post or tree, the fore and hind fetters and tethering chains are applied, the hind chain is tied to a post or tree behind, the animal is then made to bring his fore-legs as near as possible to the post round which the fore tethering chain is tied. The fore-legs are now brought together as close as possible, and a long rope is wound round the limbs above the fetters in a figure of 8 and secured between the legs. The elephant is then made to place his hind

legs together, when they are tied in a similar manner to the fore-legs, only much higher up (about half-way up the limb) and a tethering chain applied. The free end is secured round a tree or post.

To fix the head a long rope is taken : one end is tied round the post and the free portion passed under and over the neck and round the post three or more times and carefully tied.

An elephant can shake a man off his back. To diminish the chances of such an accident, take a long rope, pass it round the neck and tie a knot between the shoulders ; carry the free end under the tail round to the loop where it should be knotted near where the first knot is tied ; by this means it is almost impossible for a man to be shaken off. This leaves only the trunk to be dealt with, and any mischief from this source can be guarded against by the presence of the mahout on the neck, and a man or two below armed with spears.

- (b) Fetter both the fore-limbs ; then take the tethering chain attached to fetter, say on left leg, and pass it over the neck ; the animal is now made to assume the crouching posture ; the free end of chain is then passed through fetter on right side, brought back over the neck, and the operation repeated once or twice and the chain secured. It is as well to apply a few gunny-bags over the neck, as it is liable to become galled if the animal strains much.

These means are not sufficient to secure all animals for operation. There are some so vicious at times that little can be done without endangering the lives of attendants.

In the jungle and in Siam a "break" or "crush" is sometimes used (*see* Figs. 17 and 18). This consists of a number of stout rough logs set in a V-shaped manner. The elephant is ridden or driven in at E, and when he gets past the double posts at B—B, posts (C and D) are run through at A—A and B—B to prevent his getting out, and to prevent his backing. In this cramped position he is unable to apply his strength.

It may on very rare occasions be

necessary to throw an elephant for the purpose of operation.

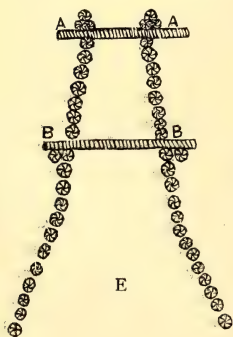


FIG. 17.

I only tried it once, and this was at Pakôkku. The elephant, a fine powerful and most troublesome tusker, was suffering from a severe wound on the spine, also two enormous abscesses on

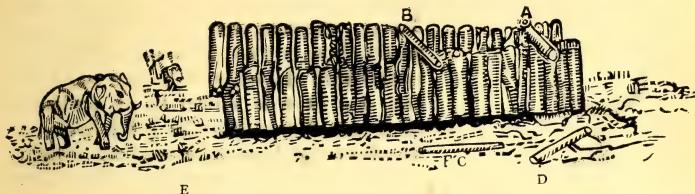


FIG. 18.—Crush.

Employed for handling and breaking in unruly elephants, especially those not allowing men to mount them. Can also be used for operations.

FIG. 17.—Poles in position at A and B.

FIG. 18.—Poles in position above, withdrawn below C and D.

the back; he would not permit any interference. While the mahout was trying to dress the wound, the elephant started the bear-like motion and the man fell off and was injured. The cooly could do nothing beyond applying fetters; the animal could not be induced to assume the recumbent posture, so we determined to try and throw him. Two heavy tuskers were brought in case matters became serious. The animal was tethered by one fore-leg to a tree with a good stout chain; fetters were then placed on all four legs, a long chain being fixed on one fore-fetter; this chain was passed through all the fetters; the free end was given to a very fine old elephant, "Rajgopal"; he immediately started to walk away; the men about then took their spears mounted on long bamboo shafts (Fig. 19), and whenever opportunity offered they touched a fore or



FIG. 19.—Common spear with which every elephant cooly should be provided, in case of his charge becoming unmanageable by getting *musth*, etc.

hind foot causing him to draw it away. As "Rajgopal" had a steady strain on the chain, we soon got the legs so far under the beast that he was obliged to sink down amidst much shrieking and trumpeting.

The abscesses were promptly opened and dressed, the wound owing to the presence of maggots was opened up and the maggots removed, after which he was allowed to get up, which he only succeeded in doing after several efforts. The shaking he got or the relief afforded by the operation quietened him down; he did not try to injure any one, and next day after a little trouble he allowed the

cooly to mount and dress the wounds. This elephant after a course of tonics made an excellent recovery (*see* Appendix B).

The *kya-pazat* is used for the recapture of escaped elephants.

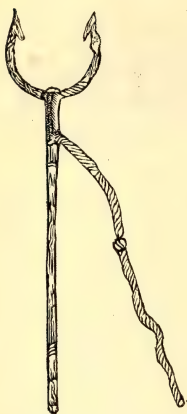


FIG. 20.—*Kya-pazat* (tiger's mouth).

Some animals after being free for a time, though permitting men they know to approach them, will not allow them to mount, so this kind of *kya-pazat* is used (*see* Fig. 20); the head is similar to an ordinary pitch-fork, but barbed like a fish-hook, it is wide enough to stick on to a limb; a light chain or rope is attached to a ring on it. The head can be fixed on a long bamboo. The man sneaks about the jungle after his animal and when opportunity offers sticks the pitch-fork on a hind limb; the handle soon comes out, but before long the rope or chain gets entangled in bushes, and the animal cannot get away.

A more barbarous method employed by Karens and Shans is to load a gun with a piece of pointed cane, *pyingado* or *thingan*. If it does not lame the animal sufficiently to effect his capture it upsets his temper and makes him a nasty customer to meet.

Most mahouts arm themselves with a light iron hook fixed into a cane or bamboo handle about 2 ft. in length (Fig. 21). It should only be employed in emergencies. Some drivers only use a pointed stick.



FIG. 21.—Driving hook with iron head and wooden shaft.

From time to time endless other coercive appliances have been devised for purposes of restraint (Fig. 22); though patience and



FIG. 22.—Iron chain collar with sharp points.

gentleness should be exercised in dealing with any animal, it is still more necessary in these creatures, and everything should be tried before forcible measures are resorted to.

The following are the instructions laid down for securing elephants in the "Manual of Mountain Artillery," 1882 :—

- (i) Anklet on one fore-foot only ; the other ankle linked through the ring of a long chain, hook-end secured round a tree, post, or into the ring-bolt. For day use.
- (ii) Long chain round one hind-leg to tree, post, or ring-bolt. For day use.
- (iii) Above, with anklets on both fore-feet.
- (iv) Anklet on one fore-foot only, the other linked on ring-bolt.
- (v) Both anklets on fore-feet, coupling chain through ring-bolt.
- (vi) Above, with long chain on one hind-leg (only allowed in special cases).

Instructions for securing elephants for transport by train or sea are given in the Government Regulations on the subject.

BOLTING.

This is one of the most dangerous, but fortunately rare, vices of the elephant. It is nearly always the result of fear. Small animals such as fox-terriers are particularly distasteful to them and, ridiculous as it may appear, often cause them to bolt. On one occasion in the Shan States I saw a tusker carrying my kit suddenly run away trumpeting ; the only cause I could assign was that a couple of cackling hens ran out close to him from under a hut. In the open it is poor fun being on the back of a runaway elephant, but in jungle, it is needless to remark, a very serious matter. Blind-folding with a cloth often answers in checking their flight, but all animals known to be liable to bolt should have a fairly long heavy chain attached to a hind



FIG. 23.—Soolays or Andoos.

leg; the free end should be attached to the saddle within easy reach of the driver, so that if occasion arises he can release it in the hope that it may be caught in some bush or stump. Sanderson cured a bolter by having a hoop of iron made with sharp spikes to encircle a hind-leg, *soolays* of the Burmese (see Figs. 23 and 24).

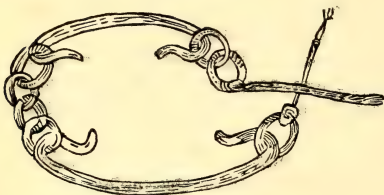


FIG. 24.—Hind fether for one foot only. It consists of two bent pieces of iron joined on one side by a short strong chain or rope and fastened off on the other by a line which is tied to a tree. The bent pieces of iron have four sharp points turned inwards, which on the elephant attempting to move enter the leg.

This was kept in position round the leg by being suspended from the pad by a rope, and it fitted the leg so loosely as not to inconvenience the elephant except when required. To the ring was attached a chain 15 ft. long, at the other end of which was a pick-axe head. This grappling-iron was slung

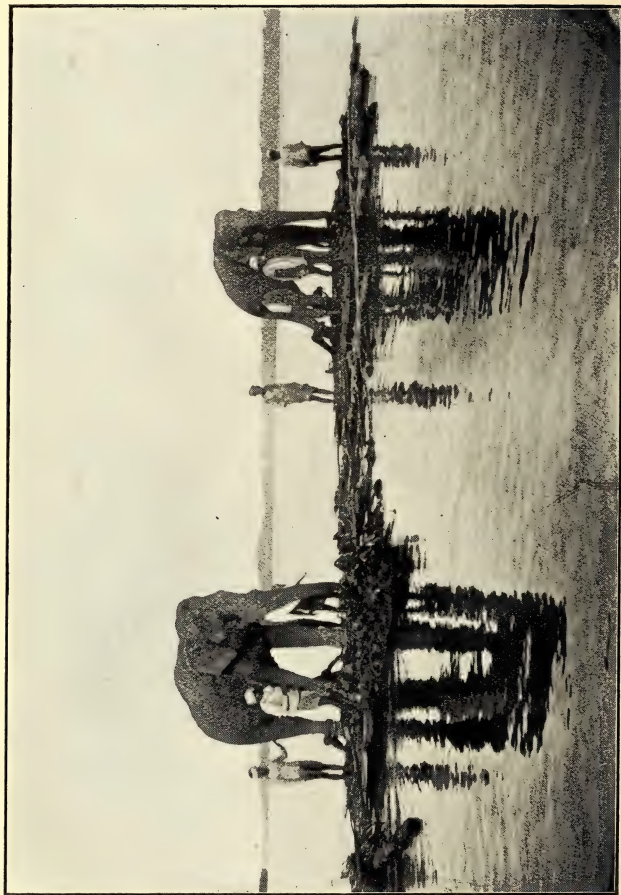
to the pad by a cord in a slip-knot, handy to the mahout who could set the anchor free with a pull at the cord. In the Karen Hills I noticed that unruly beasts and those given to bolting generally have a hole about the size of a rupee pierced through the lobe of one ear. A piece of cord is passed through the hole, and the free ends kept handy by the driver. On giving trouble the driver hangs on to the string; the method appears to be fairly effective. The *oo-sis*, when bringing certain animals in from grazing, pass a cord through the hole in the ear, take hold of the free ends and lead the animals into camp. A method employed in Siam with nervous elephants is very effective: a bent hook like a magnified fish-hook hangs loosely on the ear close to the head; a string is attached to the eye on the straight end. When the animal is nervous and shows signs of wanting to bolt, the coolly pulls on the string.

Some mahouts take the trouble to teach their elephants certain methods by which they alone can approach and catch their animals when out grazing. For instance, a driver seeing his elephant hails him, upon which the animal at once charges down on his keeper with (to a stranger) apparently alarming intent, but having done this he permits himself to be caught.

Other elephants will permit their fetters to be removed from the near or off-side only, and some will only allow approach from behind, or the driver must pass under the elephant's uplifted trunk, before he proceeds to remove a fether.



PLATE V.



ELEPHANTS BEING RAFTED.

These little eccentricities are useful in a way, in that they help to prevent a casual thief, or a professional, who has perhaps not had an opportunity of studying the habits of certain animals he desires to steal, from capturing them.

CROSSING RIVERS.

The impropriety of taking an elephant into water, whether for fording or other purpose, or permitting him to squirt water over the body when heated, has already been noted; a number of serious ailments, of which cramp is not the least formidable, may follow the disregard of this precaution. Before crossing a river, if the animals be heated they should be halted, allowed to cool, and have their gear removed. A good landing place on the opposite bank should be selected, and if the river is wide or moderately so and in flood, due allowance must be made for current. It is always a good plan to send in a well-trained animal with an intelligent driver to lead the way; the remaining elephants should be sent in batches of twos or threes. A rope should be tied round the neck, or round the girth, and a second rope attached, the free end of which the mahout can hold when the animal is in deep water. If the elephants have had a longish swim, or a stiff current to contend against, they should be allowed a short rest. With an unruly animal I found the plan recommended by Steel answer well, namely to put the troublesome elephant between two quiet animals and to tie them neck to neck; the attendant should carry a knife in case it may be necessary to cut the rope. In rivers where the fords are not well known, a quiet elephant and a good swimmer, with an intelligent driver, should be first sent across to explore the route. Elephants are good and powerful swimmers. In deep water the driver should stand, as the animals are fond of ducking themselves. When materials are available for making rafts these may be employed for transporting them across long stretches of water (*see* Plate V).

QUICKSANDS.

If an elephant, for want of being preceded by an attendant to explore the route, should chance to get into a bad quicksand or quagmire, the best plan is to throw him large billets of wood or branches of trees, which he can work down under his feet until he has obtained a sufficiently strong footing to extricate himself. On such occasions it is dangerous to approach within reach of his

trunk, as he will seize every object he can for the purpose just stated. It may be necessary to sacrifice the load.

DESTRUCTION OF ELEPHANTS.

It occasionally happens that owing to severe injury or incurable disease an animal has to be destroyed. To those who may be

DIAGRAM FROM "SANDERSON" SHOWING POSITION OF THE BRAIN WITH
REFERENCE TO THE SHOOTING OF ELEPHANTS.

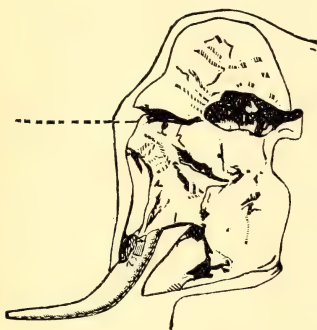


FIG. 25.—Head in natural position.



FIG. 26.—Frontal shot indicated by dotted line. Side shot indicated by blank space.



FIG. 27.—Position of head when charging.



FIG. 28.—Frontal shot indicated by dotted line.

called upon to do this it is necessary to know the shots by which the brain may be readily reached. The brain is not large and is situated low and far back. The places usually selected are the forehead, ear, and behind the ear (*see* Figs. 25 to 28).

- (a) *Front or forehead.*—The point to aim at is the centre of the forehead, near the top of the large bump at the base of the trunk, which if a line is drawn between the eyes would be about 3 inches above them. Both the person shooting and the animal should be on more or less level ground, the animal also facing and carrying the head in the natural position.
- (b) *Ear, temple or side shot.*—The animal standing on more or less level ground and head held in natural position; the best spot to aim at, if the person shooting be also on level ground, is the ear-hole, in a line to pass through the opposite ear-hole. Other side shots may be taken in the region of the temple, depending on position of person shooting.
- (c) *The rear or behind ear shot.*—Sanderson describes as follows :—"The spot behind the ear is in the hollow just over the large lump or swelling at the junction of the jaw and neck. It must be taken at about an angle of 45 degrees with the elephant's course from behind."

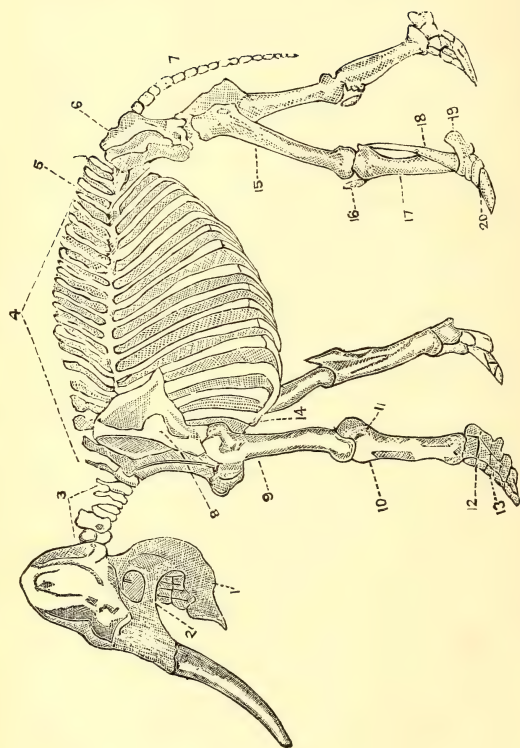
When charging the head is elevated and the trunk curled up, so it is necessary to fire at least a foot lower than when the head is held in the natural position. If a tusker, fire between the tusks.

The chief thing in shooting an elephant is to approach as close as possible in order to make certain of the shot, as the mark at a little distance is easily missed. Cover should be taken, and the best time to stalk the beast is while he is feeding; great care must be paid to the direction of the wind, which should be from the animal; the wind should be taken every few yards with feathers, wood-ashes, or any very light material.

With regard to the weapon to be used, there are many advocates for small bores, and a rifle such as a .303 with nickel bullet, owing to its great penetration, will kill an elephant as efficiently as a much larger bore; still picked shots are required and luck also, and we seldom hear of the animals wounded by small bores and not bagged. A small bore is a poor weapon when face to face with an infuriated elephant. To inexperienced persons, I recommend the heaviest weapon they can conveniently carry, such as a .470 cordite (nickel bullets), a .577 express, with steel-tipped bullets, or better still, an 8-bore with hardened lead bullets. It is desirable to have a second rifle at hand in case of accidents.

The body shot should be taken rather low, a little above and behind the elbow just near the wrinkle usually observed in that region. This shot should not be taken where people are about, as even with a 4-bore bullet placed in this position an animal may run for 60 or 80 yards.

DIAGRAM OF SKELETON OF ELEPHANT.



- | | | |
|------------------------|--------------------|------------------------------------|
| 1. Lower Maxilla. | 11. Ulna. | 16. Patella or knee-cap. |
| 2. Upper Maxilla. | 12. Carpal bones. | 17. Tibia. |
| 3. Cervical Vertebrae. | 13. Digital bones. | 18. Fibula. |
| 4. Dorsal Vertebrae. | 14. Sternum. | 19. Os calcis (one of the tarsus). |
| 5. Lumbar Vertebrae. | 15. Femur. | 20. Digital bones. |
| 6. Sacrum and Pelvis. | | |
| 7. Coccygeal bones. | | |
| 8. Scapula. | | |
| 9. Humerus. | | |
| 10. Radius. | | |

PART II.

Outlines of Anatomy and Physiology.

CHAPTER I.

THE SKELETON.

THE anatomy and physiology contained in this and the following chapters is merely intended to convey a general knowledge of the animal's structure, the position of the various organs and their functions, sufficient for the reader unacquainted with these subjects to recognize the structures probably affected in such injuries or diseases as may come under his observation.

External form is dependent upon an internal basement structure. This consists of a number of definitely but diversely shaped masses of a hard substance called bone. This basement structure is known as the skeleton. The bones entering into its formation are of various forms and sizes, depending on the uses for which they are intended. They are divided into four classes: long, short, flat and irregular. The first named are situated in the limbs; they have a shaft and two extremities. *Examples*:—Arm bone (humerus), thigh bone (femur). The scapula or shoulder blade, pelvis, and frontal bones of the head are examples of flat bones. The bones of the vertebral column are examples of the irregular type of bones, and those of the knee and hock are short bones. Bone is a tough, hard, elastic substance consisting of animal matter impregnated with earthy salts. The earthy salts may be removed from the bone by immersion in dilute hydrochloric acid; the figure of the bone remains unchanged, but instead of being hard, it will be found to resemble cartilage or grizzle, and may be twisted in any direction. The composition of bone is as follows:—

Earthy matter	...	...	...	66·7
Animal matter	...	...	...	33·3
Total				100·0
				— (Ashby).

The ends of the bones are constructed in different ways to permit of more or less motion. In some parts there is a ball and socket arrangement; in others, hinge-like joints, and so on.

The skeleton gives support to the animal frame, and affords fixed objects for the attachment of various parts. In order to admit of motion, the bones are connected one to another by means of strong bands known as ligaments.

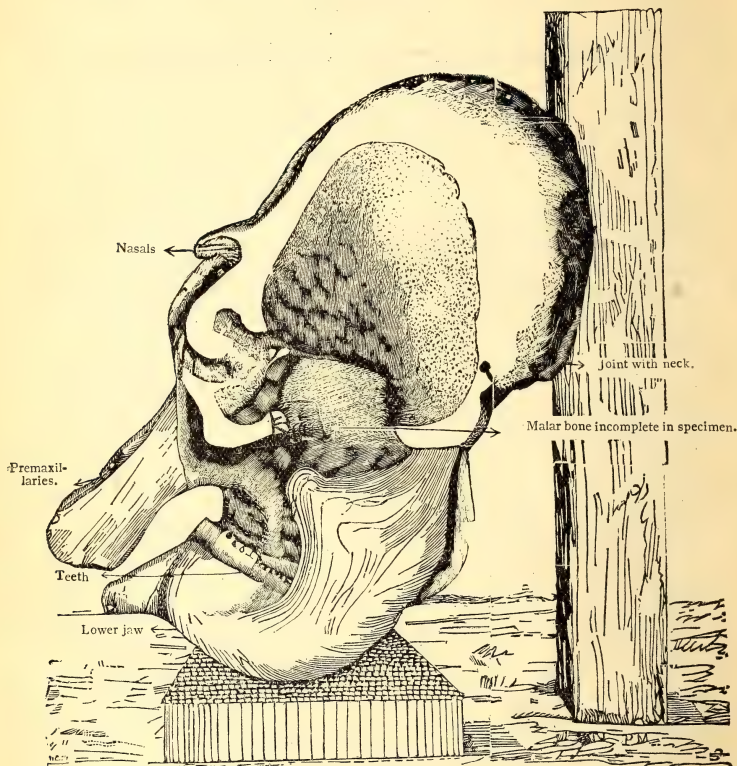


FIG. 29.—Skull of elephant.

Locomotion is effected by means of muscles, which have usually two separate attachments to bones, so that when they contract, they become shorter and broader, and the points of attachment are thus brought nearer.

Articulations.—The various bones that form the skeleton are connected together in different ways: such connections are known as joints or articulations.

In the skull we find the bones united by a dovetailed arrangement (sutures), the edges of the bones are serrated, the projections of one bone fitting into depressions of the other, which are held together by the periosteum (the membrane covering bone). In joints such as these no motion is required.

The connection between bones in the spinal column is an example of another form of joint. Here only a very limited amount of motion is required, and we find that the contiguous surfaces of the bones are connected by interposed cartilaginous tissue running from one bone to the other.

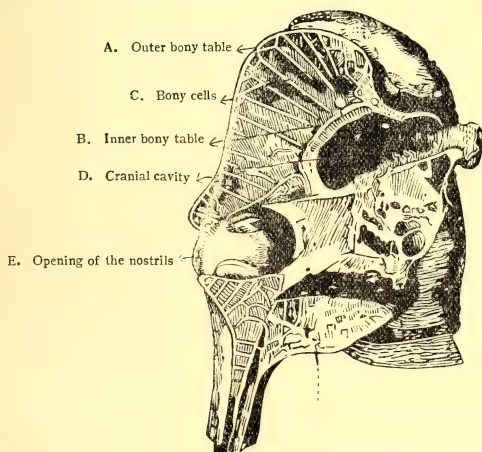


FIG. 30.—Section of skull, after Owen.

And lastly, we have movable joints. In these joints we have the surfaces of the extremities covered with a thin layer of cartilage, or grizzle (a firm elastic substance of a bluish colour: it helps to lessen friction, gives freedom to movement, and to diminish shock), which is surrounded by a capsular ligament, and this is attached to the edges of the articular surfaces. This ligament is lined by a membrane which secretes synovia, a lubricating fluid commonly called joint oil. The amount of motion permitted varies least in the knees, and greatest in the ball and socket joints, as shoulder, hip.

Skull (see Figs. 29 and 30).—The construction of the skull differs widely from that of most animals. The cranial much exceeds the facial portion in size, its upper part forming an expanded dome, the remainder being formed of bony cell structure (air sinuses),

which separate the outer from the inner table of the skull; the structure is so disposed as to afford great strength with little material. During early life these cavities are small, but with age they increase greatly.

The nasal bones are short, triangular, and pneumatic, forming the lump or boss seen immediately above the root of the trunk. The cavities or sinuses are broken up into numerous subdivisions by irregular partitions, and are lined with a delicate membrane; they communicate freely with one another and with the nasal cavities, and while their aggregate bulk constitutes a very considerable portion of the skull, so very thin and light are they, that if a section be made of that portion of the head which includes the greater portion of them, it will be found to weigh from 8 to 11 lbs., whereas that of the entire skull often exceeds 100 lbs. in weight. The average weight of five skulls of male elephants was found to be $114\frac{2}{3}$ lbs.; one of these, however, was an exceptionally large head, weighing $175\frac{1}{2}$ lbs., *i.e.*, upper jaw 59 lbs., lower jaw $116\frac{1}{2}$ lbs. Owing to the peculiar structure of the skull referred to, a large extent of bony surface is provided for the attachment of muscles, without materially adding to the weight of the head, and by means of the air contained in the sinuses the skull is rendered buoyant, the animal being thus enabled to support the enormous weight of the teeth and lower jaw. The large amount of cell structure interposed between the outer and inner tables of the skull affords such an important organ as the brain great protection.

The bony nostrils are formed by the nasal and premaxillary bones; the nasal chambers are very short and vertical. The turbinal bones situated within the nasal aperture are rudimentary, and it is here that we find the apertures admitting air into the extensive air chambers of the skull.

The lachrymal bone is small, protuberant, and imperforate.

The cavity in which the brain is lodged is situated low and far back. The brain is oval in shape (*see* Fig. 31), and the division between the large and small brain is vertical, *i.e.*, they lie on a level plane without overlapping. "The olfactory lobes from which the nerves of smell proceed are large, whilst the nerve of sight and muscular nerves of the muscles of the eye are singularly small for so vast an animal; and one is immediately struck by the prodigious size of the nerve which supplies the proboscis with its exquisite sensibility, as well as by the great size of the motor portion of the nerve which supplies the same organ with its power of movement and action."—(*Emerson Tennent.*) In animals of ordinary size the brain weighs from 15 to 17 lbs.

The lower jaw is short, the ascending portion being almost as large as the horizontal branch; the junction between the two is

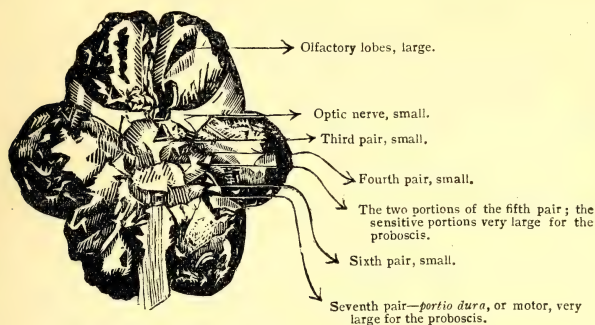


FIG. 31.—Brain of the elephant, showing origin of important nerves, from J. Emerson Tennent.

short and pointed. The dental canal is wide and excavated to accommodate the enormous grinders and to afford space for the formation and growth of the succeeding teeth.

Teeth: (Dentition.—2/o, c.—o/o, m.—6-6/6-6.)—The teeth are large, complex, and special in their mode of replacement. Steel in his "Indian Veterinary Manual" gives an excellent description of the process, which I take the liberty of quoting: "Generally on each side of each jaw two or three teeth may be seen; the front one is small, often loose, and is sometimes shed, because the growth of the second gradually cuts off the supply of nutriment by compression of the fangs. The second or main tooth consists of a number of subdivisions composed of dentine coated by enamel, arranged in a linear series from before backwards. All these are buried in an enormous bed of cementum, layers of which are between each subdivision, and coating every part of the surface, except the depressions for the pulp cavities and the table or grinding surface of the tooth." In the Indian elephant the enamel on the tables is arranged in transverse ridges. Only two teeth as a rule can be seen on each side of the jaw; these are pushed out and replaced by others growing from behind. Many male elephants possess tusks; these are placed in the premaxillary bone; they grow from a persistent pulp.

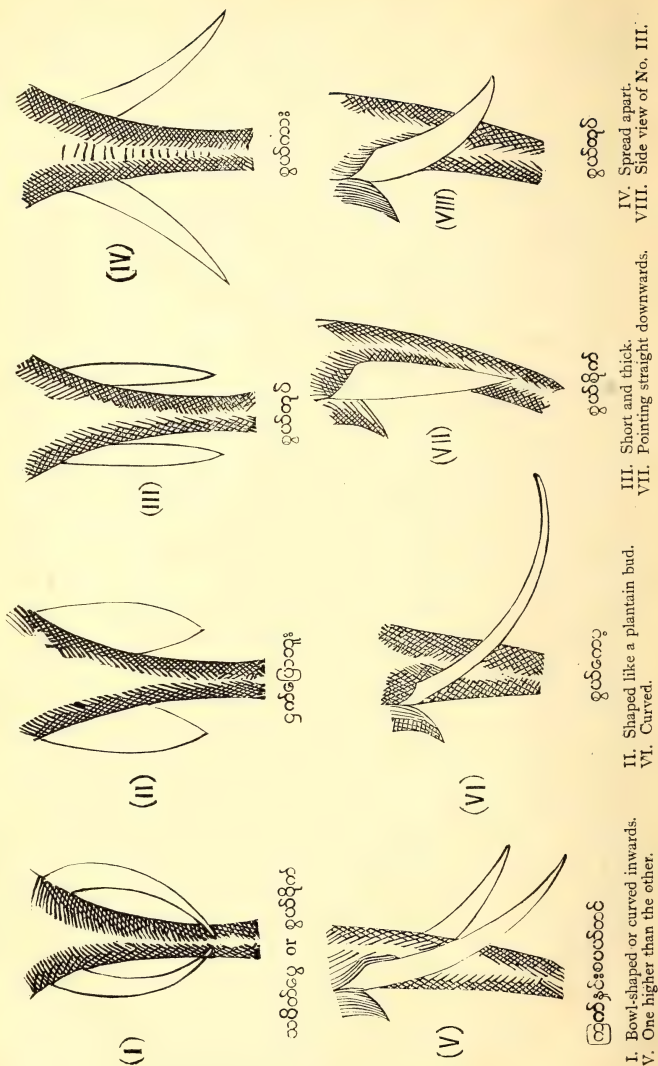
The statement of Corse in "Brewster's Edinburgh Encyclopædia" with reference to the growth of the teeth, and quoted by Steel ("Indian Veterinary Manual," page 28), is most interesting: "The

first set of grinders or milk-teeth are not shed, but are gradually worn away during the time the second set are coming forward; and as soon as the body of the grinder is nearly worn away, the fangs begin to be absorbed. From the end of the second to the beginning of the sixth year the third set come gradually forward as the jaw lengthens, not only to fill up this additional space, but also to supply the place of the second set, which are during the same period gradually worn away and have their fangs absorbed. From the beginning of the sixth to the end of the ninth year the fourth set of grinders come forward to supply the gradual waste of the third set. In this manner to the end of life the elephant obtains a set of new teeth as the old ones become unfit for the mastication of his food. The milk-grinders consist each of 4 teeth or laminae; the second set of grinders of 8 or 9 laminae; the third set of 12 or 13; the fourth set of 15, and so on, to the seventh or eighth set, when each grinder consists of 22 or 23; and it may be added that each succeeding grinder takes at least a year more than its predecessor to be completed."

Not more than one or portions of two on each side of each jaw come into wear at once; they come into use successively from behind, and as they wear out are shed in front.

The term "tush" is applied to the small tusks of females and some males, though the latter ordinarily carry the large teeth known familiarly as "tusks." Tusks and tushes are simple teeth found in the upper jaw embedded in deep bony sockets, the pulp cavity (in young elephants) extending into them for a considerable distance; but in aged animals the cavities are much diminished in size. On removing a tusk the pulp which resembles a large conical-shaped sausage may be taken from the cavity without trouble. The Burmans prize the pulp, as it is considered a specific for some disease. With regard to the *tushes*, Steel states: "The *tushes* afford indications of age appreciable to natives. Sanderson erroneously affirms they are never renewed or shed. They vary much in different varieties, and no doubt his remark applies to some; however, in others the milk tusks are shed between one and two years of age and replaced by the permanent ones which often attain 70 lbs. weight in the male." Sanderson, page 67, says: "The tusks of the male elephant-calf show almost from birth. I believe that they are never renewed, and that the first tusks are permanent. In many works on the elephant it is stated that the first tusks are shed before the second year, but I believe this to be an error—one that has gained ground through so many writers deriving their information from a common source. I have made this a point of particular enquiry amongst experienced elephant-attendants, and

BURMESE NAMES APPLIED TO DIFFERENCES IN DIVERGENCE, CURVES, ETC., OF TUSKS.



have found them unanimous in dissenting from the idea of any such process of renewal." He also remarks: "I have had many young elephants in my charge and never noticed anything of the change alluded to." I have asked many foresters, Burmese and Karen, about this matter; they are of opinion that the tusks are never shed; I have however also been informed of one or two instances of milk tusks being shed and renewed. Blanford* states that the incisors (tusks) are preceded by milk teeth, shed at an early age, and have enamel only on the tips before these are worn away.

A small percentage of males have simple *tushes*, which are similar to those of the female, except that they are a little longer and thicker, and some have none at all; the first are known as *han* (𑄎𑄓) and the latter as *haings* (𑄎𑄓𑄎). Some few males have a single tusk only. The Burmans consider it lucky to own an animal possessing a right tusk only; such an animal is known as a *tai* (𑄎𑄓) (see Plate X). Selous remarks it is far from uncommon to meet with one-tusked animals amongst elephant cows in South Africa, though rarer amongst the bulls. He also states that when an elephant has only one tusk the bone on the other side is quite solid and shows no sign of a hollow where the fellow ought to be. Males occasionally lose a tusk when fighting, or through other injury, but some are born with a single tusk. The late Mr. Darwood, who owned many elephants, records a case where one of his elephants dropped a male calf which grew up with only one tusk.

Burmans, Karens, and others, when judging the age, carefully examine the tusks with regard to their soundness, size, colour, sweep, spread, and amount of wear shown.

Tusks are formidable weapons of offence; they can be brought into use at almost any angle. Tuskers in a herd maintain discipline, and are justly feared by the members of it. At times most ghastly wounds are inflicted with these weapons; and when tuskers fight, one or other of the combatants is frequently killed, or dies of wounds inflicted. Well-trained tuskers are highly valued, as owing to the possession of these organs they are enabled to perform a variety of work which cannot be undertaken by animals without them. Strange as it may appear, there are occasional instances where a *haing* is feared even by powerful tuskers. Mr. C. B. Lacey informed me of one or two cases within his knowledge. Mr. Danson also informed me of a case, and I myself have met with one instance. It is also a generally recognized fact amongst the Burmans. In such cases it will usually be found that the *haing* is an enormously powerful elephant with an unusually fine development of the trunk;

* Fauna of India: "Mammalia."—Blanford.

the strength and dexterity in its use when fighting against a tusker is said to compensate fully for the absence of tusks. In Pegu, some years ago, a reliable Burman tracker casually informed me about a fight he witnessed in the jungle between a very large *haing* and an ordinary sized tusker; though the *haing* received some nasty wounds, he put the tusker to flight.

Tusks are occasionally snapped during fights. Mr. Danson, of Messrs. Darwood & Co., showed me a piece of a very fine tusk fractured about a foot or so from the point. This piece when found in one of the Shweli forests was covered with congealed blood. Mr. Petley, who knew the facts, informed me that the fight occurred between a good-sized wild tusker and an enormous solitary *haing* which was well known in the district (Shweli). Several Burmans witnessed the combat, during the course of which the *haing* snapped off the large portion of tusk referred to.

Emerson Tennent states that Mr. Mercer, Civil Political Officer of Government at Badulla, sent him a jagged fragment of elephant tusk 2 ft. long, weighing between 20 and 30 lbs., which had been brought to him by natives who, being attracted by noise in the jungle, witnessed a fight between a tusker and one without, and saw the latter seize one of the tusks of his antagonist and wrench from it the portion in question.—(*Emerson Tennent*, 1859, Vol. II, page 280.) Ceylon elephants are generally tuskless—not one in a hundred is found with tusks. They have tushes 10 ins. to 12 ins. long and 1 in. to 2 ins. in diameter.—(*Emerson Tennent*, page 274.)

The spine.—The spine, or backbone, is composed of a number of bones termed vertebræ. In animals the head is suspended from it. It also forms a tube for the accommodation and protection of the spinal cord, a part as important as the brain itself, being the bond of union between all parts of the body. The backbone is possessed of great strength and flexibility. For convenience of description it has been divided into five regions: namely, cervical, dorsal, lumbar, sacral, and caudal. In the Indian elephant there are 7 cervical, 20 dorsal, 3 lumbar, 3 or 4 sacral, and 31 caudal vertebræ. Owen gives the following: cervical 7, dorsal 20, lumbar 3, sacral 3, caudal 31; while Blanford states it to be: cervical 7, dorsal 19 to 21, lumbar 3 to 4, sacral 4, caudal 26 to 33. There are undoubtedly variations and peculiarities in individual skeletons. In some specimens there are only 19 dorsal vertebræ bearing movable articulated ribs.

Cervical vertebræ.—Seven in number. The first, from its supporting the head, is known as the atlas: it is very similar in appearance to that bone in the human subject, and is in form something after the shape of a signet ring. The second or axis may be

readily recognized, as it possesses a conical tooth-like process, and has a massive spine which is bifid posteriorly. The bodies of the fourth, fifth, and sixth are short; the spinous processes are also short. The seventh may be distinguished by its long spine, and also by its having on its posterior edge a cavity for the articulation of the first rib. Owing to the immense weight of the head we find that the neck is extremely short. The latitude of motion possessed by each bone on those to which it is attached is not as great in elephants as in most other animals; accordingly, we find the general flexibility of the neck is comparatively limited, and that when an animal is desirous of observing an object posterior to the direct line of vision it is necessary for him to turn his body more or less in that direction.

Dorsal vertebræ.—Nineteen to twenty in number. They are intermediate in size between the cervical and lumbar, and are to be distinguished by their long superior spinous processes, which proceed upwards and incline backwards; they form the “withers” and greater portion of the spinal ridge. They also bear articular surfaces for the reception and attachment of the heads of the ribs.

Lumbar vertebræ.—The lumbar vertebræ are three in number; they may be distinguished by their longish, flattened, transverse processes, which give support to the muscles of the loins.

Sacral vertebræ.—The sacrum is short and arched, and formed by the union of three or four bones which in the young animal are separate. It is more or less triangular in shape, with its base anteriorly and apex posteriorly placed. In very old animals the last lumbar vertebra may become united to the sacrum. The sacrum forms a roof to the pelvis, and affords protection to its contents.

Caudal vertebræ.—Thirty-one in number, but in many specimens it will be found that from accident, etc., there are less. The anterior ones show in a rudimentary form the essential parts of a vertebra, but posteriorly they become cylindrical rods, convex on their anterior and posterior surfaces.

The head and first bone of the neck have free motion up and down. The joint formed by the next bone of the neck also has free motion chiefly to either side. The bones of the back have the least motion; they confer strength and permit of motion of the ribs. The bones of the loins possess slightly more motion. If the vertebræ be examined, certain holes will be observed on either side; these are for the passage of spinal nerves, etc.

Sternum.—The sternum or breast bone is situated in the middle line, on the inferior aspect of the chest. In young animals it is cartilaginous, and consists of several segments, which later on

become consolidated. The lateral surfaces present indentations for the reception of the cartilages of the sternal or true ribs. The sternum also helps to protect the heart and lungs from injury.

Ribs.—The ribs constitute a series of long arched bones which are connected to the lateral sides of the spinal column above and mostly to the sternum below. There are from 19 to 20 pairs, increasing in length from the first to the tenth, after which they decrease. They are divided into (*a*) true or sternal ribs, namely, those that join the sternum directly; (*b*) false or asternal, those that do not; and (*c*) floating ribs, those that have no attachment below. The first two or three sternal ribs are very stout and short, and only slightly curved, as the chest in this region is very narrow. The articulation between the heads of the ribs and the vertebræ in the region of the chest is a synovial one, permitting of a certain degree of motion. The ribs form the walls of the chest and protect the important organs within, their articulations with the vertebræ above and the breast bone below admitting of slight motion; they assist in respiration.

Pelvis.—Pelvis or haunch bone, so called from being likened to a basin, is the medium by which the hind limbs are connected to the body. It is of peculiar conformation, not unlike the human pelvis, and is set almost vertically to the spinal column. The acetabula are the cavities provided for the reception of the heads of the thigh bones, or femora. Owen states that "the planes of the acetabula incline from the perpendicular about 70 degrees, a favourable position for transmitting weight upon the heads of the femora." There is no question that this construction is adapted for bearing downward pressure; it is a conformation in which immense strength is secured at the expense of suppleness, and is one reason why the gait of the elephant is such a source of discomfort to the rider.

The extremities.—In the skeletons of most mammalia it will be observed that the bones of the limbs are set at certain angles in order to diminish shock, especially during such acts as leaping and galloping, whereas in the elephant the bones are not set at angles but almost in a vertical line; the reason for this is apparent when we consider the immense size of the body to be supported. It is this particular formation that renders these animals incapable of making the slightest spring. Sanderson states that "a trench 7 ft. wide is impassable to an elephant, though the step of a large one in full stride is about $6\frac{1}{2}$ ft." From the position of the bones it is evident that the elephant is intended to sustain weight, *i.e.*, is a beast of burden; and this fact to some extent accounts for the discomfort experienced when riding these creatures.

The fore-limb.—The clavicle or collar-bone is absent.

The scapula or shoulder-blade is of great size; it is unequally divided by a ridge or spine, and from about its centre is a process directed backwards. The cavity with which it articulates with the next bone is very shallow, and looks downwards.

The humerus is also large, and affords extensive surfaces for the attachment of muscles.

The fore-arm consists of two bones, the ulna and radius, which in the elephant are distinct and peculiar, in that they are obliquely and permanently crossed. "The upper end of the latter (radius) is small; while the ulna not only contributes the principal part of the articular surface for the humerus, but has its distal end actually larger than that of the radius—a condition unique among mammals."—(*Flower.*)

The knee in the fore, and the ankle or hock joint in the hind-limb are situated very low down, namely just above the pad or hoof.

The knee-joint or carpus is made up of a group of 8 distinct small but very hard irregular-shaped bones.

"There are 5 digits with short stout phalanges, the terminal ones being very small and of irregular form."—(*Flower.*)

The hind-limb.—As in the case with the fore-limbs, the vertical disposition of the bones is observed, and to some extent bears a strong resemblance to the arrangement of the bones in the human subject.

The femur or thigh bone is a long bone more or less cylindrical in form; at its upper extremity is a rounded head which fits into the socket, or acetabulum, and forms the hip joint. The lower extremity articulates with the tibia (the stifle joint of the horse).

"The patella or knee-cap is slightly convex lengthwise and concave transversely at its articular surface."—(*Owen.*)

The tibia and fibula comprise the second segment of the limb. The first-mentioned is by far the larger bone; its upper end is expanded, the shaft of the bone is somewhat triangular in shape. The lower extremity is also expanded slightly to receive the bones of the hock.

The fibula is distinct from end to end: at its upper extremity it is connected to the tibia just below the joint, and its lower end enters into the formation of the hock joint.

As with the fore-foot, three groups of bones go to form the skeleton of the hind-foot, namely:—

- (a) The tarsus or hock, consisting of seven bones.
- (b) The metatarsals.
- (c) The phalanges or toes.

The foot.—By the term foot is meant the "hoof slipper" and

the parts contained within it. In the elephant the "hoof slipper" consists of the sole and toe-nails.

The shape of the sole in the fore-feet is nearly circular, while that of the hind-feet is more or less oval. It consists of a layer of soft elastic horn; and though thick and tough, it may be made to bend under pressure of the fingers. Anteriorly it bears the nails; posteriorly the margins curl upwards. On removal of the slipper and inspection of its inner surface, it will be seen to be covered with numerous indentations; these small holes lodge projections from the sensitive sole.

The toe-nails vary in number from 16 to 20, but the more usual number is 18, namely, 5 on each fore, and 4 on each hind foot. It has been already noted that the knee and hock joints are situated very low down, the digits running obliquely downwards. The terminal bone of each digit lies within one of the nails. If the internal surface of a nail be examined, it will be found to be traversed in a vertical direction by a series of horny leaves, or laminæ; it will also be observed that the extremity of the digit as exposed by removal of the nail is also traversed by a series of laminæ known as the sensitive laminæ; they fit in between the horny laminæ of the nail. It is by means of the indentations on the interior of the sole and the laminæ above noted that union is brought about between the horny and underlying sensitive structures.

The "hoof slippers" are not rigid boxes like the hoof of the horse; each digit is provided with tendons for flexing or extending it, thus permitting of a great degree of motion. The noiseless tread of the elephant is a subject of common remark. The reason for it is that a large quantity of a fibro-fatty substance enters into the formation of the foot, which goes to make a wonderful elastic cushion. The elephant is by nature intended to roam about the vast forests, where the soil is usually soft or the ground is covered to a depth of many inches by fallen leaves. Under natural conditions the "hoof slipper" affords ample protection to the underlying sensitive structures.

CHAPTER II.

THE SKIN. MUCOUS AND SEROUS MEMBRANES. MUSCULAR SYSTEM.

THE SKIN.

The skin.—In the wild state it is somewhat difficult to estimate the true colour of the elephant, as when met with they are generally bedaubed with various coloured clays or mud; but in reality the true colour is a deep greyish black. In the domesticated animal it is certainly much darker, which is due to constant washing, grooming, anointing with oils, and the black colour is very often given by scrubbing with *doh-nwe*, a species of creeper (ဒီးဒ္ဓိဝ်).

The looseness of the skin is familiar to all, and as is the case with many other animals it may be freely moved at will through the aid of a special muscle, the *panniculus carnosus*, lying beneath it. The action of this muscle is frequently demonstrated when the creature is tormented by flies. Some elephants have a bad habit of shifting their gear, or load, by frequently bringing this muscle into play.

The skin is of considerable thickness, but varies in different parts of the body. It nevertheless does not prevent its being highly sensitive—a matter of common remark—mosquitoes even causing extreme irritation, and it is this fact which explains why in the natural state we find these animals habitually besmeared with mud.

The functions of the skin are many. In the first place, it affords a protective covering to the tissues which build up the structure of the body.

As before remarked, though the skin is very thick, it is extremely sensitive. It is owing to this thickness that abscesses do not readily come to a head and burst.

In health the temperature of the skin is of a uniformly even warmth; it is free from scurf, dark in colour, and pliable to the touch. Embedded within its substance are various organs with special functions to perform.

(1) *Hairs.*—These are bristly in character, stiff to the touch, and firmly rooted, and are more abundant in certain localities. In the adult they are numerous on the forehead, lower lip, upper lip, orifices of the ears, and end of the tail. On the latter they are larger and stiffer in character, and grow from the anterior and

posterior borders and tip, extending much higher up on the anterior, where they are usually longer. Young elephants usually have much more hair about them than adults.

(2) *Nails*.—Are horny in appearance of a yellowish horn colour, smooth and when clean glossy. They contribute towards the formation of the foot-pad; they are firmly embedded, not tender, and there is usually a slight moist exudation of an oily character around the tops readily discovered by throwing a little dust over that region; they should not readily split or break.

(3) *Sweat glands*.—Small glands are situated in the skin, whose function it is to secrete sweat, which by evaporation assists in regulating the temperature of the body. This secretion, however, is slight and best seen after removal of pack-gear.

(4) *Nerves*.—These terminate in special organs in the skin, by whose agency the animal is able to appreciate various sensations, such as touch, cold, heat, and pain.

Any departures from the above may point to disease, namely—

- (a) Hairs may be unduly soft, easily removed, or are often shed, especially those of the tail. In cases of deaths from supposed snake-bite the Burmans employ as a test the pulling out of hairs and affirm that if they are easily removed the case is undoubtedly one of snake-bite.
- (b) Nails may be soft, cracked or broken, overgrown, rough or rugged, and an excessive discharge may be seen around or beneath them.
- (c) In parts there may be local tenderness.
- (d) Scurfiness, harshness and unusual dryness.
- (e) Temperature may be uneven or variable.
- (f) Cracks, sores or eruptions.
- (g) Swellings, which may be *localized*, such as in abscesses, or *diffused* as in dropsies, when the skin is distended, shown by a partial or complete effacement of the wrinkles, and doughiness.
- (h) Parasites, as ticks, lice, etc.

MUCOUS MEMBRANE

Is a delicate membrane lining those inner parts of the body which are in direct communication with the external air, namely—

- (a) From the nostrils to the minute ramifications of the lungs.
- (b) The whole alimentary tract from the mouth to the anus.
- (c) From the penis or vagina to the bladder.

It is furnished with blood vessels, nerves, etc. In health it is of a delicate pink colour; in fever and inflammations it becomes reddish, and the minute blood vessels are frequently injected; when the liver is deranged they assume a yellowish tint; and in debility and anæmia the membrane is usually pale and bloodless. In the elephant the colour of the mucous membrane covering the mouth, tongue and palate is easy to note; sometimes that covering the eye can also be seen, and this latter being of a highly delicate structure shows any changes in a marked manner.

SEROUS MEMBRANE

Is a firm white membrane lining the closed cavities of the body, *i.e.*, those not communicating with the external air. The membrane is reflected over the organs contained within these cavities. Its duty being to protect and keep them in position also by means of a very small quantity of lubricant fluid (serous fluid) which it secretes, it permits the organs to glide freely over each other without injury. In particular positions the membrane receives distinctive names: that portion lining the thorax is called the pleura; that lining the abdominal cavity, the peritoneum; while the portion which suspends the bowel is known as the mesentery. In the elephant the peritoneum is very thick, and there is a general absence of fat which is usually to be found in most animals.

MUSCULAR SYSTEM.

This system is remarkable, in that a large amount of tendinous fibre runs through the muscles, making them very tough. About the shoulders and buttocks the muscles are fleshy, but even here there is a considerable admixture of tendinous fibre. The flesh is much relished by Burmans, Shans and Karens.

CHAPTER III.

THE CHEST AND ORGANS OF RESPIRATION.

The thorax, or chest, is a large chamber bounded laterally by the ribs and their muscles, above by the spine, below by the breast-bone, and behind by an obliquely placed musculo-tendinous partition which separates it from the abdominal cavity, and known as the diaphragm or midriff. It contains the heart and respiratory organs and is deep and narrow. From researches conducted in recent years by M. Alfred Giard* and others it has been found that the pleural cavity, although present in the young elephant, is obliterated in the adult. This is a condition entirely different from what occurs in most mammals in which the lungs, though lying in contact with, have no actual attachment to the walls. This peculiarity is adapted to his mode of life, which seldom subjects him to respiratory emergencies, and his organization which does not necessitate rapid blood oxygenation.

In the lungs the blood cells are furnished with oxygen, which being circulated by means of the heart distribute it to the tissues which build up the system. Oxygen is necessary to the life of those tissues. To effect this charging of the blood cells with oxygen breathing is constantly going on, and consists of two acts: the first during which air is conveyed through the respiratory passages to the lungs to purify the blood (inspiratory act), and the second during which air with impure products generated in the system is thrown out (expiratory act). During inspiration the chest expands and on expiration it contracts. In health this double act is performed on an average 12 to 16 times a minute.

The respiratory organs.—The respiratory tract consists of—

Nostrils.

Wind-pipe.

Nasal chambers in the skull.

Lungs.

Nose.—The nasal apparatus consists of certain structures which serve to form two passages, whose function is to conduct air from without into the air chambers in the bones of the skull, and also to

* Comptes rendus des séances de l'Académie des Sciences, CXLIV, page 306, 11th February 1907, by M. Alfred Giard.

Comptes rendus des séances de l'Académie des Sciences, CXLIV, page 471, 4th March 1907.

Comptes rendus des séances de l'Académie des Sciences, CXLIV, page 318, 27th June 1907.

the back of the mouth, and so through the wind-pipe to the lungs. These passages are lined throughout with mucous membrane, in the uppermost part of which are lodged the nerves concerned in the sense of smell. It may conveniently be divided into two parts, namely, the muscular portion or trunk, and the osseous or bony.

The muscular portion or trunk is a most remarkable appendage, but is not peculiar to the elephant, as the tapir has a somewhat similar organ. It is composed of an intricate arrangement of muscles which furnish it with great flexibility, contractility, and power, so that its uses are manifold. The animal is enabled to snap off boughs, pull down saplings, pluck up bunches of grass and herbs—in fact, on his trunk depends his life, since both food and drink are ingested through its aid. He can employ it to lift and drag light weights. An elephant will not use his trunk either for offence, defence, or work where there is any probability of this extremely sensitive and essential organ sustaining any injury, and this is exemplified by the way in which he curls up the organ after the manner of a watch-spring, and raises his head when in the act of charging, and not free and uplifted as often represented in many pictures.

At the extremity of the trunk the anterior part is developed into a finger-like structure, which is capable of being approximated to the posterior wall. By means of this process he is able to pick up articles of small size, but not to the extent that he has been popularly credited with. Its contractility is shown by his power of shortening and lengthening this organ and, as will be again referred to on some future page, this contractility, by causing a shrivelling of the trunk, often serves as a valuable indication of ill-health. Again, it is through the muscular character of its walls that he is able to dilate the canals and increase their capacity during the act of suction. This muscular mechanism is supplied by the seventh pair of nerves which are unusually developed in this animal and hence accounts for its power, varied and complicated mobility. The skin covering the trunk is soft and pliable, and that in the posterior region is puckered into a series of transverse ridges, giving it a permanent roughness which materially aids in the tenacity of its grip. It is also the medium through which this organ is endowed with one of its most important uses, for it is in the deeper layers of the skin that the elements of the sense of touch are lodged. It is supplied by the fifth pair of nerves which are also unusually developed in the elephant and accounts for its exquisite sensibility.

The canals are two in number and lie nearer to the front of the organ. They are of about the same calibre throughout, and are lined by mucous membrane. They are capable of a certain amount

of distension and, in addition to serving as conductors of air to the lungs and air cells, are converted into temporary reservoirs in the act of drinking. The end of the trunk during this act is placed in the water, and by suction (an inspiratory effort) a quantity is drawn up into the canals. The trunk when a sufficiency has been taken up is withdrawn, and inserted far back into the mouth, where by an expiratory effort the contents are expelled and swallowed or in the act of bathing ejected over its body. It is highly improbable that the mucous membrane lining these canals is in any way concerned with the sense of smell.

Every one familiar with elephants must have observed the peculiar habit they have when heated of inserting the trunk into the mouth and by suction withdrawing fluid which they squirt over the body. Many theories have been advanced as to where this fluid is accumulated: some investigators say that the stomach is the reservoir and that the cell-like formation at one end (much exaggerated in the drawing) can hold as much as ten gallons of water, and Dr. Harrison found a muscle connecting the back of the wind-pipe with the forepart of the gullet, one of the functions of which he thought might be to raise the cardiac orifice of the stomach and so enable it to regurgitate its contents into the gullet. (The muscle alluded to must have been abnormal as I believe other anatomists have not found it.) Others are of opinion that a special pouch at the back of the throat (pharyngeal) is the reservoir. The point at present is not satisfactorily settled; but as Steel states, the "pouch" is capable of holding a fair amount of fluid which may be supplemented by gradual regurgitation from the stomach. The subject is a most interesting one, and those desirous of obtaining full information should refer to the excellent works of Steel, Sterndale, and Sanderson.

Selous in his book, "A Hunter's Wanderings in Africa," page 181, refers to this habit among African elephants.

Sounds.—A forcible blast of air blown through the trunk produces the sound familiarly known as "trumpeting," and another peculiar sound is also emitted through the agency of this organ. This is referred to by Sanderson, and accurately likened by him, to the sounds produced by rapidly doubling a large sheet of tin. This authority says that "it is produced by rapping the end of the trunk smartly on the ground, a current of air hitherto retained, being sharply emitted through the trunk, as from a valve, at the moment of impact." The sound is familiar to those who have indulged in elephant shooting, and appears to be a note of warning on the apprehension of danger.

Elephants make a variety of other sounds: for instance, during the stillness of the night wild elephants may be heard making a

droning noise, which may be due either to pleasure or calling the attention of stragglers to the herd. Again, when being loaded or driven hard they may roar. This sound is produced by the throat, the mouth being wide open and the trunk often uplifted. Pleasure may be indicated by the usual low squeaking through the trunk, as is often heard when elephants have been separated during the day and meet in the evening. A further well-known sound is the low rumbling made in the throat expressive of want or anger; this in a modified way is often made by calves when separated from their mothers. The common sound of "prut, prut," which is often heard when elephants are travelling, I think may indicate impatience. When elephants desire to frighten anything such as dogs, etc., they often blow through their trunks.

Vascularity.—This organ is very richly supplied with blood-vessels, and thus accounts for injuries being attended with copious hæmorrhage, which in fact may prove fatal.

The *osseous* or bony portion is so constructed as to form two irregularly shaped chambers communicating in front with the canals of the trunk, and behind with the mouth. In addition there is free communication with the honeycomb-like pneumatic chambers (or air sinuses) of the head already referred to. The chambers are lined with mucous membrane in which are embedded the terminations of the olfactory nerves, or nerves of smell, which, being unusually well developed in the elephant, accounts for the acuteness of this sense.

Larynx.—This consists of a chamber opening below the base of the tongue by which air is conducted down the trachea or wind-pipe into the lungs. It contains the *essentials* in the production of voice.

Trachea and bronchi.—The trachea or wind-pipe is a tube composed of a series of cartilaginous rings, which rings are incomplete behind. It divides into two tubes of smaller calibre called the bronchi, which enter the lungs and ramify throughout their substance. These air passages are unusually long and narrow.

Lungs.—Are two spongy organs, one on each side of the chest, to the walls of which, as already remarked, and to the diaphragm, they are intimately attached. The left can be readily distinguished from the right by presenting no deep fissures in its contour.

Healthy lungs are of a delicate pink colour and should float in water. If however the lungs be not examined till some time after death, the lung on the side on which the carcass is lying will be found blackish in colour owing to blood having gravitated into it.

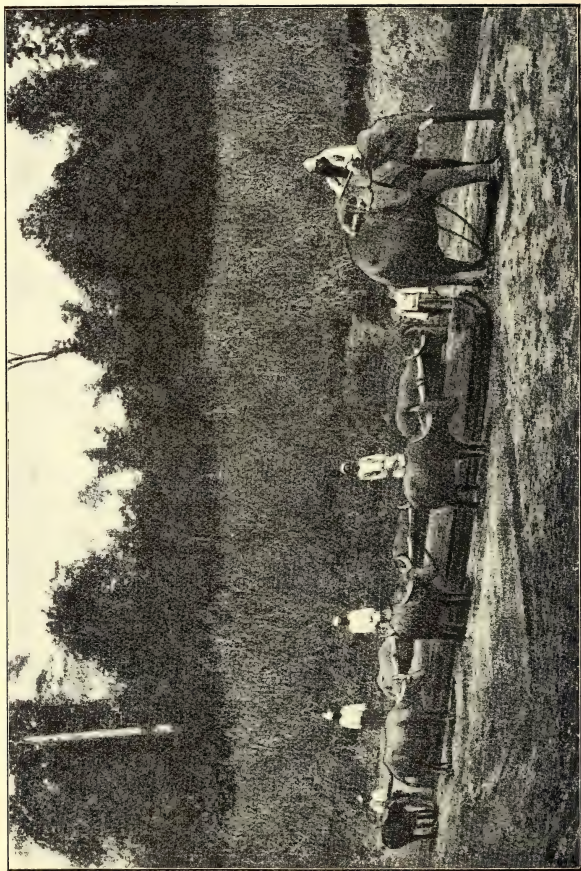
The average weight of the lungs of four animals was 46 lbs.

The mucous membrane at the orifices of the trunk is a rich pink colour and moist, with an occasional drip of clear fluid. Any

departure from those conditions may indicate disease of this tract, and may be summed up as follows :—

- (a) Undue redness of mucous membrane of trunk.
- (b) Constant dripping of a clear or opaque yellowish fluid from trunk.
- (c) Soreness inside the trunk.
- (d) Cough.
- (e) Hurried or difficult breathing.
- (f) Impaired movements of chest with compensatory increase of movement of belly during breathing.

PLATE VI.



EXTRACTING A HEAVY LOG.

CHAPTER IV.

THE CIRCULATORY SYSTEM.

The circulation of the blood is carried on by means of the heart, arteries, capillaries, and veins.

Arteries.—The arteries are the channels which convey blood from the heart, distributing it over the system. If an artery be pressed by the finger, an impulse or shock is felt, known as the pulse. They aid in forcing the blood onwards by means of their elastic walls, which are thicker than those of veins, and do not collapse when empty.

Capillaries.—Capillaries are the very minute channels which allow certain portions of the blood to pass through their walls into the surrounding tissues for their nourishment. They are the anastomotic network of vessels whereby the terminations of the arteries are continued to form the beginning of the initial branches of the veins.

Veins.—Veins are the channels which carry blood back to the heart.

The small veins unite to form main trunks which finally carry the venous blood to the right auricle, from which it passes into the right ventricle, and from thence through the artery of the lungs (pulmonary, the opening of which is in the ventricle) to the lungs. After oxygenation in the lungs it is conveyed to the left auricle, then to the left ventricle into the aorta, a large artery, which distributes the purified blood over the body.

Lymphatic.—The lymphatic system consists of a series of tubules, the lymph vessels, and a number of glands. In the elephant the lymphatic system is so poorly developed as to be almost non-existent. There are few lymphatic vessels, and the lymphatic glands are few and small in number. The main lymphatic vessel, the thoracic duct, is extremely small, being not much larger than that in man. The lymphatic vessels are for the purpose of carrying lymph from the blood to the tissues.

The heart.—The heart is a hollow muscular organ consisting of four chambers, situated within the chest and enclosed within a bag (the pericardium).

The two upper chambers are called auricles; the lower two, ventricles.

The orifices between the auricles and ventricles are guarded by valves, as also is the entrance to the pulmonary artery and aorta. What happens is roughly as follows. The blood pours into the right and left auricles which when full contract, thus driving the blood into the ventricles, which on filling, the valves shut off their communication with the auricles; the ventricles now contract, driving the blood on the right side through the pulmonary artery to the lungs for purification, and through the aorta on the left side for distribution of the blood over the system; the valves close when the vessels are filled, preventing a reflux into the ventricles.

The elephant's heart is peculiar, in that its apex presents two points instead of one like most mammals. This peculiarity is however shared by certain whales, dugong, etc. Another peculiarity is the fact that there are two large veins (*anterior venæ cavæ*) entering the right auricle instead of one as in most other mammals, in addition to the *posterior vena cava*. There is an absence of fat about the organ. The heart beats from 46 to 50 times a minute.

Weight-average of three hearts, 24 lbs.

Pulse.—"The impulse or shock caused by the overfilling of the aorta during the ventricular systole (contraction of ventricles) is the cause of the pulse."—(*Ashby*.)

In a healthy elephant when at rest, if the finger be applied to an artery, the vessel will be found to expand between 46 and 50 times a minute; a short increase or decrease may be quite normal.

Many things increase the frequency of the pulse rate—exercise, fever, fear, age. In young animals it is faster than in aged beasts.

The pulse is a useful indication as to the state of the circulation; the character also has to be noted as it varies; for instance, in debility we often get a soft and frequent pulse; in some heart affections an intermittent pulse, that is there is an occasional loss of a beat which may be regular, *e.g.*, every fifth or sixth beat, or irregular.

The most suitable place for taking the pulse is at the back and root of the ears, where will be distinctly seen a branch of an artery running over the cartilaginous root of the ear and subsequently ramifying on its surface. The pulsation will readily be felt by applying the finger. It is not however so easy a matter to determine the exact number of pulsations, as the animal approached by a stranger, and especially if in the recumbent position, will not easily be made to remain sufficiently quiet for the required time. The better way is to cause an intelligent mahout to count aloud the pulsations while the animal is standing and when the circulatory system is not disturbed by fear or exertion on the part of the animal. In every establishment one or two mahouts should be taught to take the pulse accurately.

CHAPTER V.

THE DIGESTIVE SYSTEM.

The abdominal cavity or belly is of large size, the nature of the food requiring voluminous intestines. The cavity is bounded in front by the diaphragm or midriff, which separates it from the chest cavity; posteriorly by the pelvis; above by the backbone; laterally by the ribs and their muscles, and below by the abdominal muscles. The cavity contains a portion of the gullet, the stomach, intestines, liver, spleen, pancreas, kidneys, and the urogenital organs. On opening the cavity shortly after death, it will be observed that the intestines are alternately contracting and relaxing, but always working down the gut, so as to force onward the contents. The movement, like that of the heart, is automatic.

It will be noted that the cavity is lined by a glistening serous membrane which is also reflected over the organs. This membrane is known as the peritoneum. Its function is to secrete a small quantity of fluid to prevent friction and so permit the continual motion of the bowels to go on without injury.

A striking point is the slight amount or entire absence of fat in these creatures.

The alimentary tract.—This consists of the *mouth*, through which food and water gain entrance to the system, the former being ground into a pulp by the teeth and softened by the saliva; the *gullet*, which conveys the same by the act of swallowing to the *stomach*, which is the receptacle for it and in which the major part of digestion is carried on. By this act the food comes into contact with juices secreted by various organs, and these juices have the power of altering the food and abstracting from it certain constituents which are required to replenish the wear and tear of the system. When this act has been sufficiently effected, the altered food passes into the *intestine*, a tube many feet in length, in which digestion is completed, and the altered food passed onwards, acquiring more and more the character of fæces or dung, till it finally reaches the *rectum*, in which the fæces lodge till a certain quantity is collected and is then discharged through the *anus*.

The mouth.—The cavity of the mouth is remarkably small, “a fact which is demonstrated by the precision with which the food is passed into it by the proboscis, and the small part which the lips

consequently play in the act of prehension.”—(*Miall and Greenwood.*) The roof of the mouth is quite smooth; the sides are formed by the cheeks, which are sufficiently loose to permit of limited motion of the jaws, the powerful muscles of which act chiefly in their grinding motion. In health the interior of the mouth is pinkish in colour and moist, the breath not unpleasant, appetite good (the elephant in its natural state, as has been already remarked, eating from 18 to 20 hours during the 24). The upper lip is blended with the nostrils to form the trunk; the lower lip is small and pointed. The cavity of the mouth is occupied chiefly by a muscular organ, the tongue, which is very small. The tip lies in the groove formed by the lower lip and the organ is possessed of more freedom posteriorly than anteriorly. It is the organ of taste. The pharynx is a cavity situated behind the tongue, and through it the food is conveyed to the gullet or œsophagus. A description of the teeth has already been given (*see page 65*).

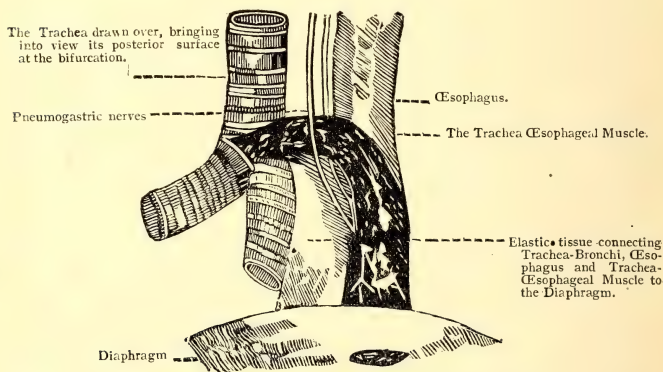


FIG. 32.—Œsophagus or gullet, after Harrison, from J. E. Tennent.

Œsophagus or gullet.—The œsophagus or gullet is a muscular tube extending from the pharynx to the stomach; the calibre of the tube is small. On the authority of Dr. Harrison, Tennent gives an illustration of a muscle passing from the posterior part of the windpipe to the gullet, which he thought “might raise the cardiac orifice of the stomach and so aid this organ to regurgitate a portion of its contents into the œsophagus” (*see Fig. 32*).

Stomach.—The stomach (*see Fig. 33*) is a simple sac, unlike that of most herbivora, smooth externally and measures from $2\frac{1}{2}$ to 3 ft. long; that of the last elephant examined (a large tusker)

measured 3 ft. 4 ins. It has two extremities, the cardiac and pyloric, and two openings, one communicating with the gullet known as the cardiac, and the other with the intestines, the pyloric. The stomach is situated towards the left side and the spleen is attached to it. The cardiac end is long and tapering; the interior is lined by mucous membrane. "A number of transverse, nearly circular folds project inward from the cardiac wall; they almost disappear when the stomach is greatly distended, and are at all times too shallow to serve as water-cells, though they have been figured and described as such."—(*Miall and Greenwood.*) I have examined several stomachs and agree with the above remark; also *see* remarks on trunk, page 77. The gullet enters the stomach almost at the centre.

THE CELLS SHOWN ARE MUCH EXAGGERATED,—*see* DESCRIPTION OF STOMACH.

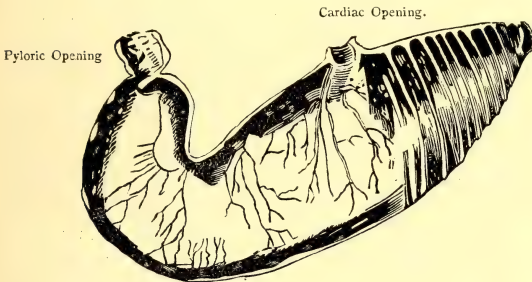


FIG. 33.—Elephant's stomach, after Camper, from J. E. Tennent.

Intestines.—The small intestine begins at the pyloric orifice of the stomach and ends on entering the cæcum, a dilated pouch some distance down. For convenience the intestine has been divided into three parts, namely the duodenum, jejunum and ileum. The intestine may be recognized by its smaller calibre and smooth regular contour when distended. The secretions poured into the small gut are bile from the liver, pancreatic juice from the pancreas, and secretions from glands in its own walls.

The respective total lengths of the small intestine of four elephants were 66, 70, 73 and 74 ft.

The large intestine is capacious and may be distinguished by its puckered appearance, due to the presence of longitudinal bands, which are shorter than the intestine. It is also divided into three

portions, namely the cæcum (is very capacious), the colon (which is the largest portion), and the rectum (which terminates at the anus), the orifice of which is guarded by a special muscle.

The intestines are attached to the spine by a strong membrane called the mesentery, which also serves to sustain the bowels, and affords passage for important vessels.

The total lengths of the large intestine of four elephants were respectively 38, 40, 46 and 43 ft. Steel records the length of bowels in an elephant $9\frac{1}{2}$ ft. at the shoulder as follows: small intestines 76 ft., cæcum 5 ft., colon 20 ft., and rectum 12 ft. Total large intestine 37 ft., and of intestinal tract 113 ft.

"Hunter gives 17 ft. as the length of the small intestine; Mayer makes it 37 ft., while he gives the total length as 75 ft."—(*Miall and Greenwood.*)

Owen's measurements taken from a young Indian elephant, about 7 ft. at the shoulder, are as follows:—

			Ft.	in.
Length of small intestines	...	...	38	0
Length of cæcum	...	...	1	6
Total length of colon and rectum together	...	...	20	0
Total length of intestinal canal exclusive of cæcum	...	...	58	6

The liver.—The liver is the largest gland in the body and one of the most important of the digestive organs. Its chief function is that of secreting bile. This is collected by small ducts or channels, which unite to form larger ones, terminating finally in a main one which conveys the bile to the intestine. Bile is a natural laxative, prevents putrefaction in the intestines, assists in the digestive process, and is the colouring agent of the dung. An oversecretion of bile therefore tends to create diarrhœa with deep clay-coloured motions. Insufficient secretion on the other hand may produce light-coloured and foul-smelling dung with constipation. Characters of the dung therefore give much information regarding the state of the liver. The outline of the organ is simple, being divided into two lobes, the right being the larger. The gall bladder is absent. The duct which carries the bile expands and forms a pouch in the wall of the duodenum; the secretion from the pancreas is also received into this pouch. The liver may be said to occupy a position roughly between the stomach and diaphragm to the right of the middle line of the body.

The weight of the liver varies between 50 and 58 lbs.

Hawkes, in the case of a male elephant aged 34 years that died from heart disease, found the liver to weigh 65 lbs., and in a very small elephant aged 24 years it weighed $58\frac{1}{2}$ lbs. Gilchrist gives the weight of this organ in an animal he examined as $76\frac{1}{2}$ lbs.

The spleen.—Average weight of four spleens was 7 lbs. It is a long flat organ, broadest at its middle and lies to the left of the stomach. This organ is generally enormously enlarged in animals that die from anthrax fever.

The pancreas.—Is a small gland in close relation to the base of the spleen and placed across the roof of the abdominal cavity.

CHAPTER VI.

THE URINARY SYSTEM.

This consists of—

Kidneys.	Bladder.
Ureters.	Urethra.

Kidneys.—These are situated one on each side of the spine beneath the lumbar vertebræ. In structure they resemble the kidneys of the ox, in that they are lobulated; the lobes are distinct, and vary in number from 5 to 6. The weight is from 6 to 8 lbs. Gilchrist gives it as 16 lbs. Their function is to withdraw from the blood passing through them certain poisonous products which have been elaborated in the system.

These poisons pass in a state of solution called urine from the kidneys through two ducts called the ureters to the bladder, where, after a certain quantity has collected, the animal voids it through the urethra or passage through the penis.

The *ureters* are two tubes which convey the urine from each kidney to the bladder. The orifices of the ureters on the inside of the bladder are in adults from two to three inches apart.

The *bladder* presents no remarkable features; it serves as a reservoir for the urine, and thus prevents the extreme inconvenience that would result from having to discharge the urine as fast as it is secreted. On the accumulation of a certain quantity, which amount varies in different individuals, a very uneasy feeling due to nervous influence is experienced, which induces the animal to discharge it. The neck of the bladder is supplied with a large amount of circular muscular fibres, their office being to keep the orifice of the bladder closed.

The urine is discharged from the body by means of the *urethra*, a membranous canal extending, in the male, from the neck of the bladder to the extremity of the penis. In the female it is very short and opens into the uro-genital canal.

The elephant passes water from about 10 to 14 times during the 24 hours. This fluid in health has the following characters—specific gravity, 1,004; colour, watery or faint amber, and towards the close of the act may be a little turbid; it is clear and has a peculiar characteristic smell, not disagreeable. Any deviation from

the above should lead one to suspect disease of the urinary tract, namely—

- (a) Increased frequency in making water.
- (b) Arrest of the flow (suppression).
- (c) Constant dribbling.
- (d) Offensive smell.
- (e) Alteration in colour. It is invariably high-coloured in fever; may be greenish when the liver is affected, and markedly reddish when mixed with blood.
- (f) Pain evinced by straining and groaning during the act of voiding; also by increased restlessness, denoted by frequent changes of posture, that is constant shifting of feet, lying down and getting up.

CHAPTER VII.

ORGANS OF REPRODUCTION. MILK. BREEDING. PREGNANCY. PARTURITION.

ORGANS OF REPRODUCTION.

The male organs of generation.—In the male we find glands (testicles) to secrete the seminal fluid and an organ, the penis, by means of which this fluid may be conveyed to the female.

The testicles are two glandular bodies, globular in shape; the substance is soft and on section of a light brownish colour. They are suspended freely in the abdomen and are situated below the posterior extremities of the kidneys.

The penis is a long fleshy body, which serves to afford passage to the urine and also to eject the semen. At its extremity is the opening of the urethra which in this animal is Y-shaped.

With a view to preventing that peculiar sexual disturbance known as *musth*, many attempts have been made to castrate these creatures; but owing to the immense size of the carcase and the peculiar position of the testicles, the operation is necessarily a very formidable and dangerous one. The operation must be performed on both sides.

The female organs.—The female organs of generation are divided into external and internal.

The external or uro-genital opening known as the vulva is not situated near the anus, as in many animals, but is drawn forward and so occupies the position of the penis in the male. The sides are loose and the labia or lips covered with mucous membrane form a prepuce or covering for the clitoris.

On separating the lips of the vulva, a fleshy body varying in length from 12 to 16 ins., known as the clitoris, is observed. It is the homologue of the penis in the male.

The internal organs are the vagina, uterus, fallopian tubes and ovaries.

The vagina is a canal lined by mucous membrane. It is about 12 to 15 ins. long.

At the end of the vagina is the entrance to the uterus or womb, which organ is peculiar in that the greater part of it is divided into two horns. Outwardly, the uterus is with difficulty distinguished from the vagina.

The fallopian tubes are two tubes leading from the horns of the uterus to the ovaries.

The ovaries or female testicles are small bodies surrounded by a firm, fibrous capsule. The substance consists of a network of tissue, blood vessels, etc., in which are embedded the ova which are destined, on being fertilised, to develop into the offspring.

Impregnation.—The ovum on being discharged from the ovary is caught by the abdominal extremity of the fallopian tube from which it is passed on down to the uterus, where if it is unimpregnated it dies and is discharged; but if impregnated by the spermatozoa contained in the seminal fluid, undergoes certain changes which ultimately result in the reproduction of the species. The impregnated ovum goes through a series of divisions and subdivisions, until finally it becomes a mass of cells arranged in three more or less distinct layers which form the embryo. The embryo very soon becomes enclosed in membranous sacs developed from the middle and outer layers mentioned above and joining the foetal membranes. Connection with the uterus is obtained by little short finger-like processes (villi) growing from the outer surface of the external membrane (chorion) into folds or crypts in the uterine mucous membrane. The chorionic villi become surrounded by a plexus of maternal vessels thus bringing the maternal and foetal blood into close relationship. These structures are known as the placenta. Placentæ are therefore those structures developed for the purification and nourishment of the foetal blood; they are of two types:—

- (1) Deciduate, in which new maternal tissue is found in connection with the uterus during gestation and lost after birth, *e.g.*, the human placenta.
- (2) Non-deciduate (animal) placenta.

Placentæ are also classified according to the disposition of the villi as—

- (1) Diffuse, when the whole surface is covered by villi.
- (2) Cotyledonary, when the villi are only met with in clumps or tufts.
- (3) Zonary, when the villi are arranged in a strap-like manner round the membranes.

The placenta of the elephant is non-deciduate and zonary.

MILK.

The udder consists of two glands and is situated on the breast just behind the fore-legs. In the virgin state it is small, but during the latter period of gestation it becomes considerably enlarged and

some little time before parturition milk is secreted. The glands consist of lobes bound together by connective tissue and fat. The milk as secreted is carried by sets of channels which converge at a point where they form dilatations which act as reservoirs. The ducts again become contracted and open finally on the summit of the nipples or teats, of which there are two.

"The milk of the elephant is said to be very rich, with an agreeable taste and odour, its butter and sugar being largely increased at the expense of the water as compared with other milks."

—(*Steel and Symonds.*)

BREEDING.

At one time it was much doubted whether elephants ever bred in captivity. That it does happen, and not infrequently in Burma and Siam is beyond question. It is true that under certain circumstances, *e.g.*, when animals are constantly tied up, etc., it is very rare for them to breed; but with elephants the property of large firms engaged in the timber industry, and those owned by contractors, the case is different; after work the animals are permitted to roam about the jungles where they lead a more natural life and under these conditions calves are often dropped. There are many well-known cases of elephants now working whose mothers were working for years before their birth. In Burma where wild elephants are numerous, cases of wild males taking up with tame females are not infrequent and tame elephants appear to have little or no difficulty in gaining admission to wild herds. As long as a sufficient number can be procured by capture, it would be absurd to attempt to breed them. Owners, especially of working elephants, have been known to offer to give away calves owing to the expense attending their keep and the remoteness of the prospect of some return upon the outlay. The offer has for similar reasons frequently been refused.

In the female the loose external generative opening hangs down in much the same situation as that occupied by the penis in the male. This peculiarity led to a good deal of speculation as to the manner in which union of the sexes took place; so much so as to suggest a deviation from the analogy of other animals for this purpose. The question as to the manner in which the fecundation of the female is brought about was set at rest at Thayetmyo, where two elephants were observed in the act and in the position common to quadrupeds, but in order to place the matter beyond the possibility of contradiction, Mr. Porter, Schoolmaster of the Bedford Regiment,

took an excellent photograph; the trunks and tails came out rather indistinctly; this, Mr. Porter afterwards informed me, was due to the fact that they were in constant and rapid motion. The congress lasted some time. Some time ago I received a remarkable photo. from Mr. H. G. Batten, of the Burma Commission, depicting elephants during congress in an open space and they were more or less surrounded by men armed with spears. During February 1902 the late Mr. Slade had opportunities of obtaining most accurate information on this subject. He was enabled to take a remarkable series of photographs, the elephants paying no attention whatsoever to the people being round about. The animals in question were his baggage elephants. The mahouts having suspicions informed Mr. Slade who ordered a close watch to be kept. The tusker showed no sign of *musth*. A cow he was said to have a particular liking for screamed and strained on her chains at his approach and was accordingly set free; another cow also tethered evinced no fear. Mr. Slade remarked that there was considerable play beforehand, which may have led to the erroneous opinion that congress lasted some time, whereas it only occupied one minute. The position of the male is, as I have noted, similar to that of other animals, except that the fore-legs are placed one on each side of the spine (not on the sides) and are run along the back as far as the shoulders; the tusker neither grips nor steadies himself with the fore-legs and he gradually sinks on his hind-legs till he almost assumes a sitting posture, then gradually raising himself till his hind-legs are straight. After congress the tusker moves off and remains silent; the females showed some excitement by trumpeting softly, flapping their ears and whisking their tails.

As the male keeps his fore-feet so close together, the statement made by Burmans to the effect that a fettered male loose in the jungle is capable of mounting is correct.

Mr. Slade could not discern any signs of the cows being in season, though by their behaviour he was certain three of the four with him were so during the 10 days he was in camp. In fact he was quite certain that it was the female and not the male that came into season and until she does the male takes no notice. Mr. Slade observed that this tusker mounted one cow daily from the 20th to the 27th February inclusive; on the 28th she did not respond to his addresses, though not evincing any fear. The three cows were Hla U, Kalè Ma, and Nu Nyun. No result followed in the case of Hla U, who was covered on the 21st, 22nd, 23rd, 24th and 28th February. Kalè Ma gave birth to a male calf on the 14th February, practically two years after, and Nu Nyun dropped a dead calf in September 1903, 19 months after.

Sanderson witnessed the act on four occasions and on none of these did the males exhibit any signs of *musth*, which goes to prove that it is not only when under this influence that male elephants court the society of the female. One jump is considered to be sufficient. Sanderson states: "there is ample proof that it is not the male elephant that comes into season." Owing to the periodical attacks of *musth* many people have supposed that such is the case; and he remarks that "the period of heat is not marked by any particular signs in the female, which has probably helped to strengthen the erroneous opinion spoken of. In approaching a male elephant, a female desirous of his attentions utters certain sounds and courts his society; but only those conversant with elephants would notice this." I have never observed any apparent signs of "heat" in the female and several friends I consulted informed me that though they had seen a great many elephants, and had been amongst elephants many years, they had not seen anything noticeable amongst female elephants beyond the fact already stated that the female when in that state utters certain peculiar sounds.

PREGNANCY.

Sanderson states that female elephants usually give birth to their first calf at 16 years of age and continue to breed till they reach the age of 80. A remarkable instance proving that they may begin to breed much earlier is recorded by Mr. W. A. Bell, of the Bombay Burma Trading Corporation, who had authentic knowledge of the facts. One of the Corporation elephants dropped a female calf on the 6th May 1894. Exactly nine years and one month from that date this young cow, to the astonishment of everyone, dropped a calf and subsequently died. No one had the faintest suspicion that she was in calf. The calf was practically full term. They breed about every two and a half or three years. Calves are not weaned for two or three years. I have seen two calves (wild) at heel; the elder one I do not think was more than three years of age. Sanderson has seen three. The same authority observes that the female will not permit a bull to approach until eight or ten months after calving. Burmans and Karens put it down at even a longer period (see Appendix F).

Elephants in calf may be worked up to almost their full term, but it is only fair to relieve them from work six weeks or so before the calf is expected. Towards the end of pregnancy females become very lazy and sluggish; the size of the animal, taken

together with the fullness of the mammary glands and the presence of milk, should afford sufficient indications of approaching parturition.

The dams after calving should be given a good rest and a plentiful allowance of good nourishing fodder.

The young suckle with their mouths and not with the trunk.

The duration of pregnancy may be said to vary between eighteen and twenty-two months. Sanderson gives it at eighteen months for a female calf and twenty-two for a male. Burmans and Karens state that it may extend to two and a half years.

Mr. Petley kindly gave me notes on two cases:—

(a) A female was covered during the first fortnight of April 1896, and a male calf was born on the 6th February 1898—22 months.

(b) Mr. D. S. Pritchard witnessed the tusker "Yegyan" cover the female elephant "Bohgadow" near the Yatsauk bazaar during the month of February 1896; she dropped a calf (female) during December 1897; Mr. Pritchard saw the calf an hour after birth—22 months.

Steel quoting from the "Asian" of the 5th June 1883 gives two cases, the duration of pregnancy being 583 and 680 days respectively.

In the "Indian Forester" for April 1899, Vol. XXV, page 158, signed "C. B. S.", a case is recorded. A female turned out with others to graze was covered in May 1897. The act was observed every evening for about a week, from about the 18th to the 25th May. Neither of the animals showed signs of sexual excitement previously though the male paid assiduous court to the female for a few days before coition was permitted. They were both working regularly dragging timber, and gave no trouble. A female calf was born on the 3rd November 1898. The day the youngster was born, the mother had carried a light load for a short march. The calf was so weak that it had to hold on to a bamboo with its mouth to keep itself upright. After a day it could stand and suckle. Period of gestation—a little over 17 calendar months.

In exceptional cases parturition may take place in 17 months, *vide* case instanced by "C. B. S.", and as late as 24 months as in case recorded by Mr. Slade.

In two other instances brought to my notice the periods were 19 and 21½ months respectively; in the former case the calf was a female, in the latter a male.

The greater number of calves are dropped during the last quarter of the year, though several are produced at other seasons. The late Mr. Bruce, of the Forest Department, informed me that he had knowledge of at least seven cases where calves were all dropped

during March. I think one may reasonably say that in large wild herds one may at any season find a youngster or two only a few weeks old.

PARTURITION.

Generally speaking, the period of labour is short and the act of parturition occupies but a short time. One calf occurs at a birth as a rule.

Mr. Lidderdale kindly wrote to me describing the birth of a young elephant at Pazundaung. The cow had been working in the timber-yard during the afternoon and after work was as usual tethered in her shed about 6 P.M. About 11 P.M. she became very restless and groaned loudly; at about 3 A.M. she suddenly broke her hind shackles; so those on her fore-feet were removed, after which she walked out of the shed into some deep mud about five yards distant, where she promptly assumed the recumbent posture and gave birth to a female calf in caul which I believe is not an infrequent event (head and fore-feet presented). The act of parturition occupied but a few minutes. The Burman attendant, who had been present at other cases, immediately ruptured the membranes, etc., the calf remaining lying on its side (the mother standing over it) for an hour or so, after which it managed to stand up and in a short time could walk. The "after-birth" (*achin*) came away 15 or 20 minutes after the birth of the calf. The dam ate it.

An intelligent Burman gave me the following description:—

"When the full time has arrived, most animals are very restless and in great agony for some few hours, and often an hour or so before birth there is a discharge from the passages. When about to give birth the female seeks soft ground. The calf may be presented head and fore-feet first or the hinder parts may appear first. If the membranes are not ruptured by an attendant and the calf set free, the female will do so with her foot. The young one lies from one to two hours after birth, occasionally moving ears, trunk, and limbs; after which it gets on its legs and can walk."

Elephants even in their wild state may die in labour. In 1900 I found the remains of a cow elephant in the jungle and a Burman well-known to me informed me that he had seen the carcass a few days after the animal died, and that the cause of death was due to her inability to expel the calf.

A young one can walk well enough after a few days to follow the mother on a short march and here I may mention that in their

wild state, when a calf has been dropped, the herd remain in the vicinity until it is able to follow the mother, which is generally in about forty-eight hours. Elephants generally eat the after-birth.

At birth the calves are usually covered with longish hair, and stand from two and a half to three feet at the shoulder. A cow belonging to Sanger, of Circus fame, dropped a still-born calf in the London Zoo. Measurements were as follows:—

Length from tip of trunk to end of tail, 95 ins.; trunk, 21 ins.; height at shoulders, 35 ins.

Sanderson weighed several calves when two days old and found the average weight to be 200 lbs. For several months they live entirely on milk and even for some time after they take to eating grass, their chief support is milk. The trunk of the young animal is very short from 10 to 15 inches in length. Mothers rarely resent their youngsters being handled. The calves soon become playful and very mischievous.

The mother should not be marched for two or three days after the birth of the calf.

CHAPTER VIII.

THE NERVOUS SYSTEM AND SPECIAL ORGANS.

The nervous system.—The nervous system consists of (a) the brain, (b) the spinal cord, (c) the nerves.

- (a) The brain is contained within the cranial cavity. It is the organ that regulates every vital process in the body; it is the seat of the will and intelligence; it controls all motion, appreciates and locates sensation, and its activity is exhibited in part by what is termed consciousness.
- (b) The spinal cord is contained within the vertebral canal, and is in relation to the brain what a local post office is to the general post office. It only controls certain functions of the body and even in those is itself controlled by the brain.
- (c) The nerves are merely conducting media between sensitive surfaces or organs and the brain and cord. They are the telegraph wires which convey the messages emanating from the brain or spinal cord, the outcome of which may be seen in a variety of ways, such as size of the pupil, degree of redness of mucous membranes, the activity in the secretion of a gland, the movement of a muscle or a limb, the voiding of excreta, etc.

Eye.—The optic nerve is responsible for the sense of vision and is unusually small in the elephant, the reason for which is evident when one considers the small size of this organ and the muscles required to move it. The eye resembles that of other animals. The visible portion consists of a transparent convex disc like a watch glass called the cornea, behind which is the coloured portion of the eye (iris) which is usually brown, and centrally the pupil which is jet black and round. Vision is acute, but the animal is greatly handicapped in making use of this sense to a degree equal to that of most animals by virtue of the shortness of its neck which will not permit of the head being turned sideways sufficiently to see objects in its rear: therefore the only way this can be effected is by a movement of the body, and this is exemplified by watching an elephant walking when it is suspicious of something in its rear.

It will be seen to alternately move the body from side to side in order to see what is occurring behind instead of walking straight forwards. However, the limited field of vision is fully compensated for by the extreme acuteness of smell and perhaps partially by its keen hearing. As is the case with many animals, in addition to an upper and lower eyelid there is a membranous fold placed at the inner corner of the eye and beneath the lids which is capable of being moved outwards over a considerable portion of the eyeball: this is called the nictitating membrane, the *haw* (of horses), and by some authors the "third eyelid." This outward movement is effected by a retraction of the eyeball which displaces some fat behind the orbit and so mechanically thrusts the lid forwards.

Lachrymal apparatus.—The eyelids furnished with eyelashes blink every few seconds and a slight watery discharge flows over the cheek. There is no true lachrymal (tear) gland, but this is replaced by a gland situated on the inner side of the orbit called the Harderian gland, which pours its secretion on to the third eyelid, whence the tears so produced fall on to the face, there being no apparatus to convey them into the nose such as exists in most animals.

The diseases of the organs of sight do not vary from those of other animals.

The following departures from the above indicate present or past disease, namely—

- (a) Frequent blinking.
- (b) Abnormal discharge, either watery or turbid.
- (c) Haziness or opalescence of the pupil.
- (d) Opalescence of the cornea.
- (e) Undue redness seen when the lids are separated.
- (f) Blindness, partial or complete.

Ear.—There is nothing of special interest to note except as previously mentioned as an indication of age (*see* page 2).

The temporal glands.—These well-known glands, called *kapool* by natives of India, are two in number and are situated one on each side about midway between the eye and ear-hole. Their ducts open on the skin in this region. The glands are usually inactive. They are analogous to the glands in deer which open into pits seen under the eyes and to the gland on the back of the head of camels.

CHAPTER IX.

ELEMENTARY PHYSIOLOGY.

The body is made up of various parts or organs, each with a separate action or function.

Organs again are composed of certain definite structures or tissues differing widely from one another, not only in their physical characters and appearance but also in their functions.

All tissues are composed of certain similar elements more or less modified, which are called cells, and the functions of the different tissues are due to the activities of their cells.

The cell is a minute mass of living substance or protoplasm, in which is situated a more or less well-defined body, the nucleus. These are the essential parts of a cell. Each little cell possesses the power of assimilating particles of food brought to it, of movement and of reproduction.

From the protoplasm of the cells the various tissues of the body—bone, muscle, nerve, etc.—are formed. The animal body is originally a single cell, and from this, by division, a mass of simple cells is produced, which become arranged in the embryo into three layers—an outer, a middle and an inner—and from these three layers the different sets of tissues develop.

Tissues are divided into two classes:—

(a) The vegetative tissues which support, bind together, protect and nourish the body: as examples of such tissues we have bone tissue, fibrous tissue of ligaments and tendons, skin and gland tissue.

(b) The master tissues of the body, muscle and nerve.

A detailed description of these tissues is unnecessary here; it will only be observed, however, for the benefit of the lay reader that there are two kinds of muscle tissue: one under the control of the will and therefore called voluntary muscle, and the other not so controlled and known as involuntary muscle, such as for instance, the muscles of the intestine. Voluntary muscles are actuated by nerve impulses from the central nervous system. Nerves pass from the skin and various tissues inwards towards the brain, carrying impressions to that organ, and from the brain nerves pass outwards to the muscles and tissues, stimulating them to action. The brain itself is nothing more than a collection of nerve-

cells. As examples of the co-ordination between muscle and nerve, we have only to observe the rapidity with which an animal, if pricked in the leg, lifts that member almost immediately, and again there is the well-known saying, "his mouth watered at the sight of so many good things," as showing the stimulation of the salivary glands by the sight of food.

Nutrition of the tissues: blood and lymph.—The blood carries the necessary nourishment to the tissues and receives their waste products. It is however enclosed in a system of vessels and does not come into direct relationship with the cells. Outside the blood vessels and bathing the cells is the lymph. Lymph may be looked upon as the middleman between the blood and the tissues; it carries nourishment *from* the blood *to* the tissues, and receives in return the waste products of the tissues to be carried back to the blood.

Blood is composed of a clear fluid (plasma) in which is suspended millions of small discoid particles—the blood corpuscles or blood cells. These blood cells are of two different kinds and are generally spoken of as red cells and white cells. The colour of the blood is due to these red cells.

When blood is withdrawn from living vessels, it clots; the red cells being the heaviest, sink to the bottom; the white cells form the next layer, while above all little drops of a clear amber-coloured fluid make their appearance which, running together, form the serum. Clotting is due to changes in the plasma as this fluid coagulates in the absence of corpuscles.

Serum is not plasma in that it does not contain the protein fibrinogen, but otherwise it resembles plasma both in appearance and composition. It contains various proteins, the most important being serum albumen, the amount of which varies according to the condition of the animal.

The other organic substances in serum may be classified as—

(i) Substances to be used by the tissues:—

(a) Glucose, a carbohydrate which is usually in larger amount in blood going to muscles than in that coming from muscles. This difference is more marked when the muscles are active.

(b) Fats, which occur in varying amounts depending on the nature of the food.

(ii) Substances given off by the tissues, *i.e.*, the waste products of tissue metabolism. The principal of these is urea which occurs constantly in minute quantities.

The principal inorganic constituents of serum are the chloride,

carbonate and phosphate of sodium. Calcium, potassium and magnesium also occur in small amounts.

White cells are of different varieties. Their most important function is the removal of useless and effete tissues, dead micro-organisms, etc. They may be looked upon as the scavengers of the body.

Red cells are circular biconcave discs devoid of a nucleus as a rule. Their colour is due to an iron-containing substance called hæmoglobin. Hæmoglobin possesses the property of taking up oxygen from the air and of giving it up to the tissues; it thus acts as the middleman between the air and the tissues. In certain diseases the number of red cells or the amount of hæmoglobin in the red cells is reduced, and the animal is said to be anæmic.

Lymph.—Lymph is the fluid which acts the part of middleman between the blood and the tissues. All the tissue spaces are filled by it, and every little cell is bathed by it. The tissue spaces open into lymph vessels through which the lymph flows to the lymph glands and thence back to the blood. In composition, lymph resembles somewhat the blood plasma, but it contains only a few white cells which are small in size and are known as lymph cells.

Lymph is a straw-coloured fluid, but in the lymphatic vessel coming from the digestive canal after a meal it has a milky appearance, due to the presence of fats in a very fine state of division which have been absorbed from the intestine.

Lymph is derived partly from the blood and partly from the tissues.

Circulation.—The means by which the blood and lymph are distributed to the tissues consists of a central force pump, the heart, and a series of tubes, the arteries, which lead to all parts of the body and terminate in innumerable fine tubules, called capillaries, in the substance of the tissues. From these capillaries a certain proportion of the blood constituents escape into the spaces between the cells as lymph. This lymph is carried away in a series of lymph vessels passing through the various tissues and organs to the lymph glands, and from there back to the heart by way of the veins. During its passage through the tissues the lymph is deprived of much of its nutrient material, receiving in return the waste products of tissue metabolism. The remainder of the blood, which has not passed out of the capillaries as lymph, has thus been deprived of some of its nutrient material; this is made up for by a part of the blood being sent through the walls of the stomach and intestine where nutrient material from the food is taken up by the blood returning to the heart. In addition to this nutrient material the blood returning to the heart contains waste products, the result of

tissue metabolism. These waste materials are partly got rid of by a portion of the blood being sent through the liver and kidneys. The blood returns to the right side of the heart (the right auricle), and from here it is pumped by the right ventricle through the lungs, where it gets rid of the carbonic acid gas and other effete material received from the tissues and takes up a fresh supply of oxygen. From the lungs it returns to the left side of the heart (left auricle) to be again pumped through the body by the left ventricle.

CHAPTER X.

ELEMENTARY PHYSIOLOGY—*continued.*

Food and digestion.—The principal use of food is to supply energy to the body, the muscles of the body being constantly active or continually liberating energy by breaking down the complex proteins, carbohydrates and fats, and therefore fresh supplies of these are necessary to prevent the body living on its own material and wasting away.

Again during growth, the material from which the body is built up must be supplied by the food, so that a suitable food must be able to yield the necessary amount of energy and also supply the materials necessary for growth and repair.

Before food can be utilised by the body it must be broken down to its simplest form and rendered soluble, and the process of preparing the food for absorption is called digestion.

Before considering the process of digestion some idea of the composition of food must be given. Foodstuffs are classified into those not yielding energy and those that do yield energy—the former acting chiefly as solvents, *e.g.*, water and the inorganic salts. The foodstuffs yielding energy are complex combinations of the chemical elements—carbon, hydrogen and oxygen, with or without nitrogen, sulphur, phosphorus and iron—that is to say, they are of the same nature as the materials found on the analysis of dead protoplasm. The energy-yielding foodstuffs are further subdivided into nitrogen-containing compounds and non-nitrogen-containing compounds. The proteins belong to the former, and the carbohydrates and fats to the latter. The proteins are important in that they are the only source of the nitrogen and sulphur necessary for the construction and repair of living tissues; they are therefore the essential organic constituents of the food. Proteins leave the body as carbonic acid, water and urea.

The difference between the carbohydrates and fats is that in the former the oxygen and hydrogen exist in the same proportion as in water; carbohydrates and fats leave the body as carbonic acid and water.

Digestion.—In the elephant the food is grasped by the trunk and placed in the mouth where, by the act of chewing, it is thoroughly broken up and mixed with the saliva.

Saliva is a turbid frothy fluid secreted by the salivary glands and various smaller glands in the lining membrane of the mouth. The active constituent of saliva is a ferment called ptyalin. The functions of saliva are two-fold:—

- (1) Mechanical, to moisten the mouth and gullet, and so assist in chewing and swallowing.
- (2) Chemical, by reason of the ferment ptyalin to convert the starchy matters (carbohydrates) into sugars.

The flow of saliva is stimulated by the act of chewing and by the sight of food.

The food having been masticated is collected on the surface of the tongue by the action of various muscles; the tongue is pressed against the palate and the bolus of food pressed backwards to the root of the tongue where it passes between the pillars of the fauces into the pharynx. The muscles of the pharynx contract and the food is forced into the gullet, which, by a slow wave-like contraction, sends the food to the stomach. During the passage of the food over the larynx the posterior cartilages are approximated, and the tip of the anterior cartilage applied to them forming a triradiate fissure through which food cannot pass. Before food reaches the stomach this organ is collapsed; the mucous membrane is pale in colour and thrown into ridges; there is little movement and the secretion is scanty, only a little mucus being found covering the lining membrane. When food arrives, however, the blood vessels dilate, a secretion is poured out and churning movements begin.

The gastric juice is secreted by glands situated in the mucous membrane of the stomach. It is a clear watery fluid containing hydrochloric acid, some organic salts and two ferments, one a protein-splitting ferment, pepsin, and the other a milk-curdling ferment, rennin. The pepsin acts on the proteins, converting them eventually into their simplest form, peptones.

On fats the gastric juice has no action further than dissolving and digesting their protein covering and thus setting them free.

The gastric juice is also antiseptic by reason of the free hydrochloric acid it contains.

After gastric digestion has progressed for some time the partly digested food is passed on to the intestine where the process is completed. The stomach plays a very small part in the absorption of food, sugar and peptones only being taken up from it.

In the intestine the food, which is now in a semi-fluid puitaceous condition and called chyme, meets with three different secretions, the bile, pancreatic juice and intestinal secretion.

(1) Bile is the secretion of the liver, and its function is to act as a solvent of fats and assist in their digestion and absorption.

(2) Pancreatic juice is the secretion of the pancreas; it is a clear slimy fluid containing two ferments, one a protein-splitting ferment, which completes the work begun in the stomach, and the other, a starch-splitting ferment similar in its action to ptyalin but more powerful.

There is also a fat-splitting ferment present which breaks up the fats into their component parts and aids in their absorption.

(3) The intestinal juice is a pale yellow-coloured fluid secreted by various glands in the lining membrane of the intestine, and containing a ferment which assists the pancreatic juice in various ways but principally by splitting peptones and many other proteins into still simpler bodies.

Movements of the intestine.—The intestine being composed of involuntary muscle tissue, its movements are of the wave-like variety and assist in passing the food along.

During its passage along the intestine the proteins, fats and carbohydrates are absorbed, and what remains is thrown out as fæces. The food absorbed is carried along by the blood stream and distributed to the tissues as we have seen. It may be used immediately as a source of energy for the production of work and heat and for the repair of tissues, or it may be stored in the body for future use; in most animals this storage takes place in the fatty tissues, so that when the usual supply of food is cut off for any reason, the animal uses its own stored materials and tissues. This is shown by the animal losing weight. In starvation, etc., the first tissues to go are always the fatty tissues.

Respiration.—All animals require oxygen; in mammalians this is taken from the atmospheric air, and the process is called respiration. The process of respiration consists of two parts:—

- (1) The passage of air into and out of the air cells of the lungs.
- (2) The interchange of gases between the air in the air cells and the blood in the lung capillaries.

The atmospheric air is composed of two gases principally, namely oxygen and nitrogen, in the proportion of 21 parts of the former to 79 parts of the latter; nitrogen is incapable of supporting life and its use seems to be to dilute the oxygen.

(1) *Passage of air into and out of the lungs*—Is brought about by the movements of expiration and inspiration.

The act of inspiration is a muscular act brought about by the muscles of the chest, the resting position of the chest being that of expiration. Ordinary expiration is mainly a passive act, being simply the return of the chest to the position of rest, but sometimes voluntarily or involuntarily expiration may be forced and in this case the act is partly due to various muscles. The chief of these

are the abdominal muscles which compress the viscera, pushing them upwards and thus press the diaphragm further up into the chest. At the same time they pull back the ribs and thus decrease the size of the chest from side to side.

Special respiratory movements, *i.e.*, coughing, sighing and yawning—

(a) Coughing is due to irritation of the respiratory tract and is produced by a forced inspiration followed by a strong effort at expiration, during which the glottis (opening of larynx) is closed but is forced open by the current of expired air.

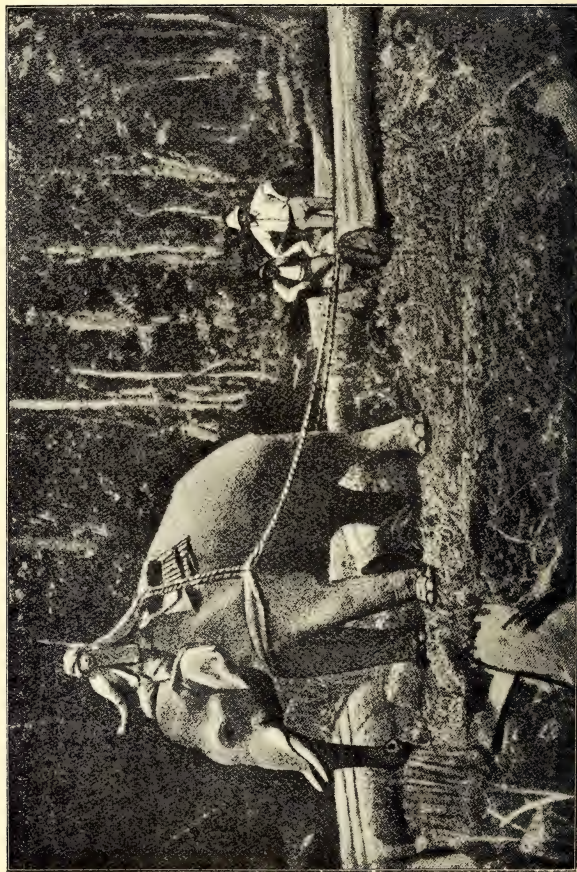
(b) Sighing and yawning are deep involuntary inspirations. They accelerate the circulation of the blood when from any reason this becomes less active.

(2) *The interchange of gases between the air in the air cells and the blood.*—This is effected partly by diffusion and partly by the activity of the air cells lining the vesicles of the lung. Carbonic acid gas and water are exchanged for oxygen, which is in turn exchanged for carbonic acid, etc., from the tissues.

Excretion of matter from the body.—We have already seen that the waste and useless material in the food, together with a certain quantity of water, is got rid of by the bowels. We have also seen that a certain amount of the products of tissue metabolism is excreted by the lungs; but there is still a certain amount of waste material which has not been accounted for, *i.e.*, the remainder of the water and the waste nitrogen of the body; these are chiefly eliminated by the urine which is secreted by the kidneys. The kidneys may be roughly described as a collection of cells arranged more or less in the form of little tubules between which capillaries run. Each tubule commences as a small sac surrounding a tuft of vessels; these little tubules collect and run together until at last we find in the centre of the kidney a small fan-shaped cavity which leads into the duct of the kidney—the ureter. As the blood passes along through the kidney, the cells of the little saccules and tubules extract from it a certain amount of water and waste solids, the most important being urea, which is the form in which about 80 per cent. of the waste nitrogen leaves the body. As it is secreted, or rather excreted, the urine passes down the ureters to the bladder, and when a certain amount has collected, the bladder contracts and it is discharged.



PLATE VII.



ELEPHANT WORKING IN JUNGLE.

PART III.

Medicines and their Administration. Formulæ.

CHAPTER I.

PREPARATION AND MODE OF ADMINISTRATION.

AS already pointed out, Veterinary Surgeons rarely have an opportunity of treating elephants, and as owners usually do not know much about their ailments, the treatment is invariably left to the mahouts. These men employ a multiplicity of drugs to make up their formulæ or *mussauls*; they are purchased in the bazaar and I have frequently seen them; excepting the curry-stuffs, the vegetable drugs are usually old, mildewed and inert, and the minerals impure.

The expense incurred by the purchase of reliable drugs from a chemist, where purity, freshness and uniformity in strength are guaranteed, would at the end of a year be far less than the cost of the ordinary expensive *mussauls* so frequently indented for. A good many of the curry-stuffs supposed to enter into them often find their way to the mahout's quarters. Domestic elephants must carry a special heat-generating apparatus in their interiors, as *gurmi* or heat seems to be the most prevalent ailment amongst them and the amount of *cooling mussauls* required is truly surprising.

No drug is known to have an emetic action on this animal. Gilchrist mentions that "tartar emetic has been given in 2-oz. doses morning and evening till half a pound was taken but no emetic or other obvious medicinal effect followed."

Mahouts are strongly averse to the administration of purgatives; in fact they never intentionally purge an animal, though such drugs as croton seeds, aloes, enter into the composition of many of their *mussauls*.

Doses.—The question of the amount of a drug to be given is a matter of some difficulty, seeing how very rare it is that opportunities offer for trying experiments on these valuable creatures. There can be little doubt however that, misled by the size of the animal, drugs have been administered in what appear as excessively large doses and not always free from risks; perhaps bazaar drugs were used,

thus leading to this error as they are often impure or inert. To be on the safe side, I have been guided by the doses given by Steel, and as he employed drugs of known strength I would recommend others to do the same. I have however given the doses quoted by other authors and have also added many of their *mussauls*. Roughly speaking the doses of most drugs for elephants are about four times that given to cattle. Doses must be regulated according to age, young animals requiring much less. In tropical countries care must be taken not to give too strong doses of purgative medicines. The strength of blisters should also be modified.

Preparation.—All drugs should be finely powdered in a mortar and mixed with spices, jaggery, honey, tamarind pulp, boiled rice, plantains, flour, ginger, cardamoms, pepper, black salt, garlic, onions, chillies, ghee, coriander seed, caraway seed, omum, mustard seeds, etc., to mask the taste as much as possible. Medicine is best given in the form of balls or pills about the size of a small orange, or less; sometimes however they are incorporated in native bread.

Administration.—The administration of drugs is not always an easy matter: the mouth is very small and, to add to the difficulty, the back of the tongue is free. In order to render it easier to give medicine, it is an excellent plan to accustom an elephant to take small packets filled with paddy, rice, tamarind, sugar or sweets, flavoured with some spice. The packets are generally made of straw, grass, and at times a plantain leaf is used. Wheaten bread or native bread (*chuppatees*) should occasionally be given, in which a little salt, spice, garlic or onions, have been incorporated. An animal soon learns to appreciate these delicacies and will open his mouth when he sees the mahout bringing a packet, which he can place in the creature's mouth without trouble. By the means above mentioned animals are rendered unsuspicious, and drugs may be incorporated and often given without trouble. The usual method is first to give a couple of packets of rice or sugar, and in the following one to place rice at the bottom of the packet, then the pill which is covered over with more rice or tamarind, then secured and pushed into the mouth. Nauseous drugs are sometimes rejected. Balls or boluses are undoubtedly the most certain and convenient method of administering drugs to elephants. The taste of nauseous drugs can to some extent be masked—a very important matter. Waste is avoided. The disadvantages are that it takes a long time for drugs to be dissolved sufficiently to be absorbed; this is augmented when the stomach and bowels are in a disordered state. It is better to give drugs in small quantities in several balls of tamarind or sweetmeat than to put a larger quantity into one or two balls. The use of gelatine capsules in which some drugs could be placed might prove useful.

Liquid medicines are often soaked up in bread and rolled in a chupatee or leaf and given. Tasteless drugs may be given in drinking water, especially if water has been withheld for some little time. Good mahouts are wonderfully clever in getting their animals to take medicines.

For a troublesome animal the following plan may be adopted. He should first of all be well fettered and have a rope tied round the neck. A wooden gag is then inserted into the mouth and secured by the ropes at the ends to the neck rope. The gag should be about $2\frac{1}{2}$ ft. long, 6 ins. broad and 2 ins. thick, the hole in the centre should be at least 4 ins. in diameter, that is large enough to permit the hand to pass through (Fig. 34); the tongue offers some resistance and care must be taken that the hand is not pushed to one side between the grinders; once the pill is pushed to the back of the mouth the animal is forced to swallow. Liquids should be carried into the mouth in a plantain leaf or in a small joint of bamboo the edges of which must be rounded off.



FIG. 34.—Wooden gag for administration of medicine.

Steel recommends that liquid medicines be pumped into the mouth by means of an enema syringe such as Read's patent. The ordinary nozzle-piece might be used for this purpose.

Castor and linseed oil are sometimes given in the following manner. The oil is placed in a tin and some spice such as cardamom or cinnamon mixed with it. The mahout then puts his hand into the mixture and rubs the medicine into the animal's mouth till the whole is finished.

Hypodermic injection.—By means of a special syringe, of which there are many patterns capable of being rendered aseptic by boiling, drugs may be introduced beneath the skin; when so injected they are quickly absorbed and their action rapidly manifested. The skin is not difficult to penetrate with a good needle. If necessary, a small incision through the skin may be made and the needle introduced. For hypodermic injections in human and veterinary practice, solutions of the active principles of drugs are generally used, such as, when opium is indicated, a small quantity of solution

of morphia is employed instead. Injections may now be procured made up in the form of pellets containing the correct dose of the active principles. They are not only more convenient, but are, when not kept too long, more reliable than made-up solutions. Good needles are requisite; they should be fairly long, say 3 ins. or so, and not too thick, in fact the finer they are the better as the animals do not resent their insertion.

The injections may be given at such places where the skin is thin and the underlying tissues loose. A fold of skin should be taken up with the finger and thumb of the left hand; the needle should then be passed through the skin obliquely under the surface. The syringe containing the injection should then be attached to the needle and the fluid injected slowly. Injections of serum, be they preventive or curative, are applied in the same way. Too much care cannot be taken in seeing that aseptic methods are observed. Syringes and needles should be boiled before and after use, and only water that has been filtered and boiled should be used for dissolving pellets or other drugs to be injected. In the matter of hypodermic injections, it is better to err on the side of being too careful rather than run any risks.

CHAPTER II.

INSTRUMENTS. WEIGHTS AND MEASURES.

INSTRUMENTS.

The following list of instruments may be found useful as part of the equipment of sick elephant camps.

Clinical thermometers.—No elephant establishment should be without this invaluable instrument, as it is a never-failing guide to the state of the health of the animal or to what it may shortly be. If there is a rise of temperature, even if no other symptoms of ill-health are manifest, we may rest assured that disease in some form will soon make itself evident: a rise of temperature is a certain indication that the animal is indisposed and should therefore be relieved from work and carefully treated and watched (*vide* Fever, page 165).

Forceps.—Two pairs ordinary spring forceps, one pair bow dressing forceps 8 ins. or 10 ins. in length. These are useful for removing soiled dressings, maggots from wounds, etc. One or two pairs of artery forceps, Pean's pattern, long jaw.

Suture needles.—Three Joger's needles for strong sutures, three Gerlach's folding needles with slide catch. Needles for use with elephants should, owing to the thickness of the skin, be provided with very sharp points and handles, and be specially made to carry moderately stout catgut and wire as the lighter kinds of sutures will not hold.

Seton needles.—Two: jointed, 12 ins. long, curved on the flat—one probe pointed, the other sharp pointed and provided with handle. One English pattern 20 ins. long with handle. A seton is an agency the effect of which is to promote the formation of purulent matter and to sustain the suppurative process after it has been established. In elephant practice setons are most useful in draining abscess cavities and pouches. The operation consists in passing a piece of tape or band of linen under the skin, and in this connection it is best to push the needle from below upwards, the reason being that no pouches are made in which matter can collect. The ends of the tape are secured either by tying round corks or sticks, or by knotting. The tape to increase the irritation is next smeared with something which promotes suppuration, such as turpentine, croton oil, cantharides ointment.

The seton should be pulled backwards and forwards at least once a day. A seton may be left in for two or three weeks, but it is desirable to change the tape every four or five days. A seton must not be kept in too long, or it may result in a ridge being formed through the exudation becoming organised.

Hoof knife.—Double-edged hoof searching knife, also a fine-pointed one, right and left. A farrier's rasp.

Bistoury.—One double bistoury.

Measure glasses.—Minim, 4 ozs., 1 pt.

Mortar and pestle.—Iron and wedgwood (two).

Probes.—Whalebone. Three, 8 ins., 12 ins. and 18 ins. in length. Used in examining and ascertaining extent of wounds, also for feeling for foreign bodies, etc. Care must be exercised in using probes in the vicinity of joints.

Saw.—Fret saw for teeth, and ordinary bone saw for cutting tusks.

Scales and weights.—Grain scales and weights. Scales and weights from 2 lbs. down.

Scalpels.—Four stout knives with metal handles to enable them to be boiled before and after use, employed for opening abscesses, etc.

Scissors.—One dressing scissors, one trimming scissors.

Enema.—Read's patent enema pump (brass), capacity 1 qt. or 3 pts.; also two ebony pipes; the ordinary one used in horse practice, about 10 ins. or 11 ins. long, may be used for administering liquid

medicines through the mouth, as suggested by Steel. The other for giving enemas should be at least double the length, 22 ins. to 24 ins. in length, slightly thicker with a larger passage. Eight to 10 ft. of good rubber tubing is requisite;

this can be fitted on to the screws of the syringe and ebony pipe.

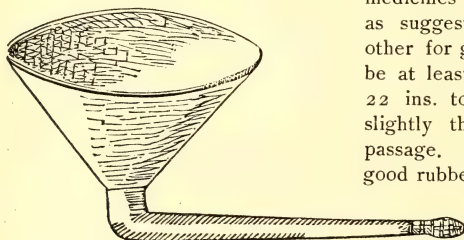


FIG. 35.—Enema funnel.

In case this pattern is not obtainable, an enema funnel may be used of the pattern (see Fig. 35); the length of the pipe must be 2 ft. at least.

Syringes.—One wound syringe, with three metal bulbous pipes, the longest to be 8 ins., for syringing out abscesses, wounds, etc., or two Quittor syringes (brass), with finger rings ($\frac{1}{2}$ to 1 pt.), and glass syringes (1 to 2 ozs.), for introduction of eye lotions, etc. Trocar and canula (Campbell's), three. These are most useful

instruments for tapping dropsical swellings and for making exploratory punctures into swellings where deep-seated fluid or pus is suspected. No harm can result from their use but on the contrary much useful information may be obtained.

They are useful to evacuate fluid from swellings. In case of abscesses, when pus is found, free use of the knife in addition should be made. Where delicate structures are underlying, care must be taken that they are not pushed too far.

Care of instruments.—All instruments after use must immediately be thoroughly cleansed, disinfected, oiled and locked up.

Steel instruments and knives with metal handles should be boiled after use, then cleansed with carbolic (not corrosive sublimate) lotion, dried, oiled and put away. Before use they should again be boiled and used at once or allowed to stand in a solution of carbolic acid or phenyle. These details may seem trifling and unnecessary, but it is careful attention to such, as disinfection of the hands, instruments, etc., that goes a long way towards bringing about satisfactory results in dealing with wounds whether surgical or accidental.

Surgical Instrument makers : Messrs. C. H. Huish & Co., Red Lion Square, London, W.C. ; Messrs. Arnold & Co., West Smithfield, London ; Messrs. Hauptner, N. W. Luisen-Strasse, 53, Berlin.

WEIGHTS AND MEASURES.

Weights.

One grain, gr.

One ounce, oz. = 437.5 gr.

One pound, lb. = 16 ounces = 7,000 grs.

Apothecaries' measure of weight.

One grain	...	...	...	gr̄
One scruple = 20 grains	...	...	...	ʒ̄
One drachm = 3 scruples = 60 grains	...	...	...	ʒ̄i
One ounce = 8 drachms = 480 grains	...	...	...	ʒ̄i
One pound = 12 ounces = 5,760 grains	...	...	...	℥̄i

Measure of capacity.

One minim	...	...	...	mi
One fluid drachm = 60 minims	...	...	...	fʒ̄i
One fluid ounce = 8 fluid drachms	...	...	...	fʒ̄i
One pint = 20 fluid ounces	...	...	...	oi
One quart = 2 pints	...	...	...	qi
One gallon = 4 quarts	...	...	...	ci

Weights used by Mahouts.

One tola = 3 drachms = weight of one rupee.

One scruple = $\frac{1}{3}$ th tola = weight of two-anna piece.

One drachm = $\frac{1}{3}$ rd tola = weight of three two-anna pieces.

One and half drachms = $\frac{1}{2}$ tola = weight of eight-anna piece.

Two drachms = 10 grains = $\frac{3}{4}$ tola = weight of three four-anna pieces.

Four drachms = $\frac{1}{2}$ ounce = $1\frac{1}{4}$ tola = one rupee and one four-anna piece.

Eight drachms = 1 ounce = $2\frac{1}{2}$ tolas = two rupees and one eight-anna piece.

Two ounces = $5\frac{1}{3}$ tolas.

One pound (apothecaries') = 32 tolas.

One seer = about two pounds.

One chittack = two ounces.

If standard measures are not at hand, house utensils may be employed. The ordinary pint bottle contains about thirteen ounces and the quart twenty-seven ounces.

Common tumblers from ten to twelve ounces, breakfast cups about eight ounces, and wine glasses two to two-and-a-half ounces.

CHAPTER III.

FORMULÆ—INTERNAL REMEDIES.

Anodynes.—Agents employed to allay or diminish pain, and of these for elephants, opium, Indian hemp (*Cannabis sativa*), henbane (*Hyoscyamus niger*) and datura (*Datura stramonium*) are the most useful.

Opium as obtained in balls may be given in doses from 2 drs. to 1 oz. :—

- | | | | | |
|---|---|-----|-----|-------------------------------|
| (1) | Extractum opii ... | ... | ... | 1 to 2 drs. |
| | Deodorized opium (United States Pharmacopœia) ... | ... | ... | 1 to 2 drs. |
| (2) Indian hemp (<i>Cannabis sativa</i>)— | | | | |
| | Bhang ... | ... | ... | 4 to 8 drs. |
| | Ganja ... | ... | ... | 2 to 6 drs. |
| | Extractum cannabis Indica ... | ... | ... | 2 to 3 drs. |
| | Extractum cannabis (fluidum) ... | ... | ... | $\frac{1}{2}$ to 1 oz. |
| (3) Dhatura { seeds ... 2 to 4 drs. | | | | |
| | { leaves ... | ... | ... | 4 drs. to $1\frac{1}{2}$ ozs. |
| (4) Henbane leaves (<i>Hyoscyamus niger</i>) ... $\frac{1}{2}$ to 1 oz. | | | | |
| | Extractum Hyoscyami ... | ... | ... | $\frac{1}{2}$ to 1 dr. |

[NOTE.—A tincture may be made by bruising $2\frac{1}{2}$ ozs. of seeds and adding one pint of proof spirit—macerate for 14 days and strain. Waring states it produces all the narcotic effect and is inexpensive when compared with opium. Dose is $1\frac{1}{2}$ to 2 ozs. This drug in its action resembles Henbane. Wide dilation of the pupil indicates that the drug should be stopped.]

- | | | | | |
|-------------------------|---|-----|-----|--------------|
| (5) | Opium .. | ... | ... | 3 drs. |
| | Camphor ... | ... | ... | 4 drs. |
| (6) Laudanum ... 3 ozs. | | | | |
| | Sweet spirits of nitre ... | ... | ... | 3 ozs. |
| | Water .. | ... | ... | Sufficiency. |
| | Soaked in bread or boiled rice sweetened. | | | |

Any of the above in doses regulated in accordance with the age of the animal and the severity of the case may be added to other medicines, namely cardamoms, nutmeg, cloves, assafoetida, but must be repeated with caution, that is half doses every four hours.

Astringents are drugs which aid in checking secretions such as diarrhoea and dysentery :—

(7) Opium	...	...	3 drs.
Powdered catechu	...	...	6 drs.
Powdered cardamoms	...	...	4 drs.
Powdered chalk	...	...	2 to 4 ozs. (mix well).

Every four hours, if necessary.

(8) Opium	...	...	3 drs.
Acetate of lead	...	...	1 dr.
Powdered ginger	...	...	6 drs. to 1 oz.

Twice a day.

Sulphate of copper	...	...	1 dr.
Or powdered alum	...	...	2 drs.

May be used in lieu of the lead.

Gallic or tannic acid may be given in doses from 2 to 4 drs. combined with opium. These acids should not be combined with metallic salts :—

- (9) Pomegranate peel powdered, in doses of 6 drs. to 3 ozs., is also a good astringent, to which may be added 2 or 3 drs. of powdered cinnamon or 1 or 2 drs. of opium.
Bael fruit is very useful, as also is solution of gum arabic.

(10) Opium	...	...	2 to 4 drs.
Gallic or tannic acid	...	...	2 drs.
Pimento, or nutmeg	...	...	4 drs.

Once or twice daily.

Carminatives, cordials, or digestive tonics.—Warm stimulating drugs generally possessing an agreeable taste and odour, such as aromatic seeds, spices. They dispel flatus, allay griping, temporarily restore exhausted strength and rouse the system. They are generally given mixed with ghee, jaggery, by mahouts, under the name of *mussauls*. They are also beneficial combined with stimulants, rum, brandy, especially to an animal suffering from cold and fatigue.

The more important are turmeric, garlic, cardamoms, nutmeg, cinnamon, coriander, aniseed, ginger, caraway, allspice, cloves, mace, cummin, mustard seeds, long pepper, black pepper, fennel, fenu-greek, liquorice, omum and assafoetida. Dose $\frac{1}{2}$ oz. twice a day; but of all these drugs as much as 2 ozs. per diem may be given. Capsicum is useful in doses from $\frac{1}{2}$ to 1 $\frac{1}{2}$ drs.

It has already been noted that, though useful when occasion arises, their indiscriminate employment is undoubtedly a source of mischief:—

- | | | | | |
|------|--------------------|-----|-----|---|
| (11) | Powdered aniseed | ... | ... | } $\frac{1}{3}$ oz. of each, to be
well mixed. |
| | Powdered cardamoms | ... | ... | |
| | Powdered gentian | ... | ... | |

Twice a day.

- | | | | | |
|------|------------------------|-----|-----|-------------------------------------|
| (12) | Powdered caraway seed | ... | ... | } $\frac{1}{2}$ oz. of each, mixed. |
| | Powdered cinchona bark | ... | ... | |
| | Powdered ginger | ... | ... | |

Twice a day.

- | | | | | |
|------|-----------------------|-----|-----|-------------------------------------|
| (13) | Powdered black pepper | ... | ... | } $\frac{1}{2}$ oz. of each, mixed. |
| | Powdered chiretta | ... | ... | |
| | Powdered liquorice | ... | ... | |

Twice a day.

- | | | | | |
|------|---------------------|-----|-----|-------------------------------------|
| (14) | Bicarbonate of soda | ... | ... | } $\frac{1}{2}$ oz. of each, mixed. |
| | Chiretta | ... | ... | |
| | Caraway seed | ... | ... | |
| | Ginger, powdered | ... | ... | |

Twice a day.

- (15) Fatigue: brandy, rum or whisky, with powdered cloves or nutmeg and warm water.

Soaked in bread or mixed with boiled rice.

Diuretics.—Agents which promote the action of the kidneys, causing an increased secretion and discharge of urine:—

- | | | | | |
|------|-------------------|-----|-----|-------------------|
| (16) | Nitrate of potash | ... | ... | $\frac{1}{3}$ oz. |
| | Powdered resin | ... | ... | 1 oz. |
| | Bar soap | ... | ... | 1 oz. |

To be well mixed and given with jaggery.

- | | | | | |
|------|-----------------------|-----|-----|--------------|
| (17) | Bicarbonate of potash | ... | ... | 4 to 6 drs. |
| | Rum or gin | ... | ... | 8 ozs. |
| | Water | ... | ... | Sufficiency. |

Especially useful in feeble animals.

- | | | | | |
|------|------------------------|-----|-----|--------------------------------|
| (18) | Sweet spirits of nitre | ... | ... | In 3-oz. doses, with
water. |
|------|------------------------|-----|-----|--------------------------------|

- | | | | | |
|------|---------|-----|-----|-----------------------|
| (19) | Vinegar | ... | ... | 4 ozs., well diluted. |
|------|---------|-----|-----|-----------------------|

- | | | | | | |
|------|--------------|-----|-----|-----|--------------------|
| (20) | Sour milk | ... | ... | ... | } 10 lbs. of each. |
| | Boiled rice | ... | ... | ... | |
| | Onions | ... | ... | ... | |
| | Green ginger | ... | ... | ... | |

Give once a day, and continue if necessary for two or three days.

- (21) Oil of turpentine, 2-oz. doses, mixed with white of egg or gruel, but must not be used when the kidneys are affected. This drug must not be given with water.

- (22) Radishes have a diuretic action. Dose 6 to 24 lbs.

The bark, root and seeds of the common moringa or drumstick fruit tree may be given in doses of 1 to 4 lbs.

Laxatives or aperients.—Agents which act gently on the bowels :—

- | | | | | | |
|------|---------------|-----|-----|-----|-------------------|
| (23) | Tamarind pulp | ... | ... | ... | } 8 ozs. of each. |
| | Common salt | ... | ... | ... | |

- (24) Castor or Linseed oil ... 1 to 1½ pts.

- | | | | | | |
|------|---------------|-----|-----|-----|--------|
| (25) | Tamarind pulp | ... | ... | ... | 2 ozs. |
| | Salt | ... | ... | ... | 8 ozs. |
| | Cassia pulp | ... | ... | ... | 1 oz. |
| | Sweet oil | ... | ... | ... | 8 ozs. |
| | Cummin | ... | ... | ... | 1 oz. |

Mix and put the whole in a tender plantain leaf and give.—*Steel.*

- | | | | | | |
|------|---------------|-----|-----|-----|---------------|
| (26) | Tamarind pulp | ... | ... | ... | 6 ozs. |
| | Epsom salts | ... | ... | ... | 10 to 12 ozs. |

- | | | | | | |
|------|------------------|-----|-----|-----|----------------|
| (27) | Sublimed sulphur | ... | ... | ... | 4 ozs. |
| | Jaggery | ... | ... | ... | A sufficiency. |

- (28) Clarified butter or ghee ... 1 to 2 lbs.

Mixed with honey or jaggery.

Purgatives.—Purgatives are medicines which cause evacuation of the bowels ; the milder are called laxatives or aperients. Mahouts are much averse to the use of purgatives.

Purgatives often cause severe griping pains ; in order to correct this they are *usually combined with some warm aromatic drugs* such as aniseed, ginger, coriander, cardamoms, caraway seeds, allspice, nutmeg, etc., in doses of ½ oz. and more.

Extract of Hyoscyamus may be used in drachm doses with the same object, combined with aloes, colocynth, etc.

Aloin is the active principle of Barbadoes aloes ; it is claimed that its action is more rapid and safer, and it has the great advantage of being *tasteless and odourless*. Its strength is three times that of Barbadoes aloes ; that is, 1 dr. equals about 3 drs. of aloes. Being a tasteless drug, it is well worthy of trial in elephant establishments. It should be mixed with some aromatic, even though it causes less griping than aloes :—

(29) Common or Epsom salts	...	...	1 lb.
(30) Cassia pulp	...	...	1 to 3 ozs.
(31) Cassia leaves (senna)	...	...	1 to 2 lbs.
* (32) Croton oil	...	...	30 to 40 drops.
Castor oil	...	...	8 ozs.
(33) Tamarind pulp	...	...	1 lb.
(34) Custard-apple leaves	...	...	100 to 250.
(35) Aloes, Barbadoes	...	...	8 drs.
Calomel	...	...	1 dr.
(36) Colocynth—the dried peeled fruit free from seeds, or the pulp— from $\frac{1}{3}$ to 1 oz. As it may cause severe griping it should be combined with henbane. Especially useful when the liver is out of order.			
(37) Aloes	...	...	4 to 6 drs.
Croton seeds	...	...	$2\frac{1}{2}$ to $4\frac{1}{2}$ drs.
Jaggery	...	...	A sufficiency.

Or, 9 drs. of croton seeds alone may be given, and repeated the following day if the animal refuses to take aloes.—*Hawkes*.

(38) Croton seeds	...	...	1 oz.
Calomel	...	...	$1\frac{1}{3}$ drs.
Aloes	...	...	6 drs.

Make into a ball with rice flour and jaggery.—*Forsyth*.

Tonics.—Agents which gradually improve the condition and functions of the digestive organs so as to enable the system to acquire increased tone and vigour. Tonics should be continued for some time. Iron, nux vomica, and arsenic are most valuable.

Nux vomica and arsenic must only be given *after food*, and it is also desirable to give them for a week or ten days at a time, after which they should be discontinued for four days or so some other

* Useful in apoplexy.

tonic being substituted during this period. Elephants can take fairly large doses of arsenic, but it is safer to give small doses and employ it with caution.

Liquor arsenicalis is tasteless and readily taken mixed in a bucket of water. Strength: 1 oz. of liquor arsenicalis contains 4 grs. of arsenic:—

(39) Liquor arsenicalis.

Dose $\frac{1}{2}$ to 1 oz., once or twice daily.

(40) Arsenic	...	...	4 grs.
Nux vomica (powdered)	...	...	1 dr.
Gentian or chiretta (powdered)	...	...	$\frac{1}{2}$ oz.

Once or twice a day.

(41) Sulphate of iron	...	...	$2\frac{1}{2}$ drs.
Nux vomica	...	...	1 dr.
Bicarbonate of soda	...	...	2 drs.
Cinchona bark (powdered)	...	...	4 drs.
Ginger	...	...	6 drs.

Once or twice a day.

(42) Carbonate of iron	...	...	2 to 4 drs.
Euquinine	...	...	1 dr.
Extract of nux vomica (B.P.)*	...	...	10 grs.
Caraway seed	...	...	2 drs.

Once or twice a day.

(43) Sulphate of copper	...	...	1 to $1\frac{1}{2}$ drs.
Chiretta (powdered)	...	...	$\frac{1}{2}$ oz.
Aniseed	...	...	$\frac{1}{2}$ oz.

Once daily.

(44) Nim or margosa bark powdered (Tama- akauk)	...	...	2 ozs.
Ginger	...	...	$\frac{1}{2}$ oz.

(45) Soda bicarb.	...	...	2 drs.
Nux vomica	...	...	2 drs.
Ferri sulph.	...	...	1 dr.

Twice a day. To be given for a week or ten days at a time. (Useful in cases of debility and indigestion.)

(45) Embelia ribes (Eik-mwe-thi) berries	...	...	6 drs.
Ginger	...	...	4 drs.

Once daily. (Useful in cases where debility is due to intestinal parasites.)

* British Pharmacopœia.

Vermicides.—Agents which kill or expel worms in the digestive tract.

Before administering these remedies, an animal should be allowed short rations for some few hours and for some hours after. These preparations will require repetition every now and again.

After expulsion of worms, good food, wheaten cakes, gruel, boiled rice and salt should be given to keep up the animal's strength and the same treatment should be adopted during convalescence, when tonics should be given :—

(47) Daily administration of salt ... $1\frac{1}{2}$ to 2 ozs.

(48) Tartar emetic	...	...	2 drs.
Arsenic	...	...	2 grs.
Sulphate of iron	...	...	2 drs.
Aniseed	...	...	$\frac{1}{2}$ oz.

Once daily for four or five days, after which a purgative should be given.

(49) Powdered black salt	...	...	$2\frac{1}{2}$ ozs.
Sulphate of iron	...	...	2 drs.
Chiretta	...	...	1 oz.

Twice a day.

(50) Santonin	...	...	1 to 4 drs.
Calomel	...	...	1 dr.
Aniseed	...	...	$\frac{1}{2}$ oz.

Once daily for a few days. (Especially useful for round worms.)

(51) Powdered seeds of the <i>Butea frondosa</i> (Pouk-bin)	...	...	4 or 5 drs.
--	-----	-----	-------------

Once daily for three or four days, followed by a purgative.

(52) Pomegranate peel (<i>Thalai-thi-akhun</i>)	...	1 to 2 ozs.
---	-----	-------------

Once daily.

(53) <i>Holarrhena antidysenterica</i> (Let-top-thein)	4 drs.
<i>Bdellium</i> (resin of <i>Balsamodendron</i> <i>agallochia</i>)	...
Common salt	...
Water	...
	4 drs.
	5 ozs.
	$1\frac{1}{2}$ pts.

Mix and give with rice, plantains, etc.

The papaya fruit and leaves may be given. Steel and Khory state that it is a good vermifuge for round worms.

External applications : blisters.—Blisters are substances which when applied to the skin cause irritation, raise it and give rise to blebs containing an amber-coloured watery-looking secretion.

Objects for which used.—(1) To raise the vigour of the circulation of the affected part by establishing a degree of irritation or inflammation of the skin.

(2) To stimulate the absorbent vessels of the part and by so doing cause removal of effused fluids.

Instructions on their use.—(a) Never apply a blister to an abraded surface or to a part when inflammation, that is heat, pain and tenderness exist. Wait till all inflammation has been subdued through the agency of other means.

(b) When the blister has acted wash off with soap and tepid water, then apply vaseline or sweet oil to the surface.

(c) *Never apply a blister at the bend of a joint.*—If desirous to apply one in the vicinity of a joint, it is necessary to protect the bend by first smearing plain vaseline into it, or better still, paint the skin with a saturated solution of resin in methylated spirit.

When using fluid blistering agents, place a little cotton wool below the part to be blistered to absorb the drip. Apply with a brush or dab on with a cloth.

The size of the blister will depend on the condition to be treated. On the loins, for the kidneys, or injury, it may be a foot square on each side. Around sores a ring is applied 2 or 3 ins. broad close to the wound but so as not to enter it. The blistered surface should be covered over with a piece of paper or cloth and protected with a rug to prevent the animal getting his trunk or tail smeared with any of the blistering agents. The mahout should remain with the elephant till blister has acted and been washed off :—

(54) Biniodide of mercury	...	...	$\frac{1}{2}$ oz.
Iodine	...	...	$\frac{1}{2}$ oz.
Potassium iodide	...	...	$\frac{1}{2}$ oz.
Vaseline	...	...	4 ozs.

—Wallis Hoare.

(55) Biniodide of mercury	...	...	1 part.
Lard, vaseline or ghee	...	...	8 to 12 (1 to 8 is a strong blister, 1 to 16 mild).

OR

Iodine ointment	...	...	1—25	} Equal parts.
Biniodide of mercury ointment	...	...	1—18	

Very useful for chronic hard swellings.

- | | | | |
|---|-----|-----|--------|
| (56) Powdered cantharides (Spanish fly) | ... | ... | 1 oz. |
| Oil of turpentine | ... | ... | 2 ozs. |
| Methylated spirit | ... | ... | 1 pt. |

Mix and allow to digest for a fortnight, occasionally stirring, then strain.
Never to be applied to the loins. Useful blister.

Caustics are corrosive applications which by chemical action destroy tissues to which they are applied and are used in foul ulcerated surfaces, spreading inflammations, or to keep down proud flesh :—

(a) *Strong caustics.*

- (57) Hot iron, rarely used on elephants.

- (58) Nitrate of silver (lunar caustic)—used in pencil as a solid.

OR

Zinc chloride. Caution must be exercised in its use as it is a very strong caustic.

The affected tissues are gently rubbed with the stick, which must like other solid caustics be held in paper or a caustic-holder.

- (59) Sulphate of copper (blue-stone)—similarly applied.

- | | | | |
|--------------------|-----|-----|----------|
| (60) Carbolic acid | ... | ... | 1 part. |
| Water | ... | ... | 3 parts. |

(b) *Milder caustics.*

- | | | | |
|------------------------|-----|-----|--------------|
| (61) Nitrate of silver | ... | ... | 5 to 15 grs. |
| Water | ... | ... | 1 oz. |

- | | | | |
|-------------------------|-----|-----|---------------|
| (62) Sulphate of copper | ... | ... | 10 to 30 grs. |
| Water | ... | ... | 1 oz. |

- | | | | |
|-----------------------|-----|-----|-------------|
| (63) Chloride of zinc | ... | ... | 1 to 4 grs. |
| Water | ... | ... | 1 oz. |

Dusting powders are dry applications used to protect raw surfaces and reduce discharges. The drugs are generally mixed with precipitated chalk, starch, or fine flour :—

- | | | | |
|---------------|-----|-----|----------|
| (64) Iodoform | ... | ... | 1 part. |
| Starch | ... | ... | 3 parts. |

- | | | | |
|----------------------|-----|-----|--------|
| (65) Alum (powdered) | ... | ... | 1 dr. |
| Charcoal | ... | ... | 3 drs. |
| Chalk | ... | ... | 1 oz. |

Especially used when there is a foul odour.

(66) Boracic acid (powdered).

(67) Oxide of zinc	...	...	...	} Equal parts.
Starch	...	...	...	

(68) Powdered catechu.

(69) Chinosol	...	...	...	1 part.
Boracic acid	...	...	...	8 parts.

Iodoform, one part, may be added to three parts of any of the above except the last and will tend to keep away flies. Lint, gauze, tow, cotton, wool, medicated with antiseptics such as carbolic acid, boracic acid, corrosive sublimate, eucalyptus, iodoform, are largely employed in dressing and protecting wounds from air, dirt, etc. Carbolized tow is inexpensive and most useful.

Embrocations or liniments are local agents used for stimulating the skin and subjacent parts in sprains, enlarged glands, etc., and require to be *rubbed* into the affected parts for ten to fifteen minutes once or twice a day.

Solution of ammonia, which is much used in the preparation of embrocations, is made as follows:—

Liquor ammonia (fort)	...	...	20 ozs.
Distilled water	...	...	40 ozs.

(a) *Ammonia liniments.*

(70) Solution of ammonia	...	...	1 oz.
Olive or sweet oil	...	...	2 ozs.

Mix and shake well.

(71) Solution of ammonia	...	...	} Equal parts.
Olive oil or other sweet oil	...	...	
Oil of turpentine	...	...	

OR

Liquor ammonia (fort)	...	...	1 part.
Turpentine	...	...	1 part.
Sweet oil	...	...	4 parts.

Shake the oil and ammonia together well and then add the turpentine and shake again.

(b) *Compound liniment of camphor.*

(72) Camphor	...	...	1 oz.
Methylated spirit	...	...	4 ozs.
Olive or sweet oil	...	...	1 pt.
Solution of ammonia	...	...	2 ozs.

Dissolve the camphor in the spirit, shake the olive oil with the ammonia and mix well.

(c) Compound soap liniment.

(73)	Soft soap	...	...	...	4 ozs.
	Camphor	...	...	...	1 oz.
	Methylated spirit	...	...	...	2 pts.
	Solution of ammonia	...	...	...	$\frac{1}{2}$ pt.

Dissolve the soap and the camphor in the spirit, then add the ammonia and strain for use.

(d) Simple mustard liniments.

(74)	Oil of turpentine	...	...	...	} Equal parts.
	Mustard oil	...	...	...	

(75) Mustard mixed with warm water (*not boiling*) and made into a thin paste.

(e) Anodyne liniment to relieve pain.

(76)	Laudanum	...	...	...	1 part.
	Soap liniment	...	...	...	3 parts.

OR

	Liq. Plumbi subacet fort (B.P.)	...	...	...	2 ozs.
	Sweet oil	...	...	...	8 ozs.

Note.—In inflammation of the mammary glands which sometimes occurs after the birth of a dead calf or when a calf dies soon after birth, the following liniment may prove useful:—

	Extract of belladonna	...	...	...	$\frac{1}{2}$ oz.
	Glycerine	...	...	...	4 ozs.
	Sweet oil	...	...	...	4 ozs.

Enemas or clysters are liquids thrown into the rectum by means of an instrument and the one recommended is Read's patent with a specially long nozzle (that is, two feet). The gum-elastic tubing does not last in this climate, but rubber tubing can be attached easily and will answer the purpose very well, or an enema funnel can easily be made (*see* Fig. 35). It consists of a tin funnel. The bend is usually made of copper into which is fixed a wooden pipe.

Objects for which they are used:—

- (1) To bring about an evacuation or emptying of the bowels.
- (2) To allay pain in the bowels or adjacent organs, such as the kidneys and bladder.
- (3) To introduce medicinal substances when from any cause they cannot be given by mouth.

Instructions for their use :—

Posture.—The animal must be made to assume the crouching posture he does while being loaded, but if possible the fore-quarters should be lower than the hind-quarters. A sloping ground will answer this purpose. The tail must be held on one side or right up by a man standing on the back.

(1) In order to evacuate the bowels, a large quantity (many quarts) must be thrown up. The procedure is as follows : As much dung as can be reached must be removed by the hand first of all, then the pipe of the syringe, previously anointed with some lubricant (vaseline or any sweet oil), must be passed gently a foot or more into the bowel ; this requires no force but gentle manipulation. If force is used there is danger of injuring the bowel wall and the creature is induced to strain down, which is just what is not desired at this time. The pipe having been inserted, warm water and soap or plain water is to be injected without force and continued till the animal can contain no more, evinced by obvious discomfort. For producing evacuation of the bowels, enemas are most useful in elephant practice ; they are to be preferred in most cases to internal remedies, producing the desired result in a much shorter time, with less pain, and at all times where the possibility of obstruction exists they are the only safe means to be employed. Again, no constipation ensues which is almost an invariable sequel to internal remedies.

(2) In this instance it is not desired to bring about an evacuation but merely to bring hot water into contact with the parts with the object of allaying pain. Hence to do good this must be retained and to effect this not more than four quarts must be injected at a time. Should this be returned, a smaller bulk must again be thrown up and this can be repeated every half-hour till pain is relieved. For this purpose water alone must be used and should be injected at a temperature of 105° F. as nearly as possible (not higher). The hand will bear this without discomfort. If less, the value of the enema is diminished.

(3) Is administered like (2), that is, with the object of being retained. Medicines are added to the enema to effect various objects, *e.g.*, relief of pain, killing parasites.

In procedure (1) the following may be added where ordinary simple enemas are not effectual :—

(a) *Where there is constipation.*

(77) Castor oil	...	...	...	1 pt.
Bicarbonate of soda	...	...	...	4 drs.
Soap, soft	...	...	...	1 oz.

Mix well with some warm water.

- (78) Turpentine, up to 4 or 5 ozs., beaten up with the whites of 3 or 4 eggs and added to 1 pt. of gruel or starch and well mixed with warm water.

- | | | | | |
|------|---------------------|-----|-----|-------------------|
| (79) | Powdered aloes | ... | ... | 1 oz. |
| | Bicarbonate of soda | ... | ... | $\frac{1}{2}$ oz. |
| | Boiling water | ... | ... | 4 qts. |

When cool enough, inject.

- | | | | | |
|------|---------------------|-----|-----|---------------|
| (80) | Salt or Epsom salts | ... | ... | 10 to 12 ozs. |
| | Warm water | ... | ... | 1 gal. |

(b) *Where there is wind as in flatulent colic.*

- | | | | | |
|------|-------------|-----|-----|-------------------|
| (81) | Assafoetida | ... | ... | 1 to 1½ ozs. |
| | Soft soap | ... | ... | $\frac{1}{2}$ oz. |
| | Warm water | ... | ... | 3 to 4 qts. |

In procedure (3) add the following:—

(a) *Where there is pain or diarrhœa.*

- (82) Powdered opium ... $\frac{1}{2}$ to 1 oz. (boiled in water, to which add thin arrow-root, rice, or starch gruel).
- | | | | | |
|------|-----------------|-----|-----|-------------|
| (83) | Laudanum | ... | ... | 2 to 4 ozs. |
| | Starch or gruel | ... | ... | 3 qts. |
- (84) Six or eight poppy-heads well boiled in water, after which add 3 qts. of rice gruel or starch.*

OR

Copper sulphate, 2 per cent. solution with or without opium, may be injected in cases of obstinate diarrhœa.

(b) *When parasites (ascaris lonchoptera) are present.*

- | | | | | |
|------|-------------|-----|-----|---------------------------------|
| (85) | Common salt | ... | ... | 4 ozs. to 2 qts. of warm water. |
|------|-------------|-----|-----|---------------------------------|

Daily.

- | | | | | |
|------|--------------------------|-----|-----|-------------|
| (86) | Oil of turpentine | ... | ... | 4 ozs. |
| | Sweet oil | ... | ... | 1 pt. |
| | Soft soap and warm water | ... | ... | 2 to 3 qts. |

Mix the soft soap with a little warm water; first beat in the oil and oil of turpentine gradually adding the warm water and use at once. Alternate days.

* The starch should be mixed with very hot water, when it swells up into a thick gruel and when cool enough is added to enemas.

(c) Stimulant enemæ.

As a stimulant, if animal is very weak :—

(87) Rum; brandy or whisky	...	...	8 ozs., beaten up with 6 eggs.
Starch gruel	...	...	2 qts.

Repeat as required.

OR

(88) Sulphuric æther	...	...	2 or 4 ozs.
Water	...	...	2 qts.

Repeat every two hours or so if necessary.

Eye applications for varic purposes are chiefly in the form of washes, ointments and powders. *Solid caustics should never be applied to the eye :—*

(a) Simple astringent eye-washes.

(89) Sulphate of copper	...	...	1 gr.
Water	...	...	1 oz.
(90) Nitrate of silver	...	...	1 gr.
Water	...	...	1 oz.
(91) Sulphate of zinc	...	...	1 gr.
Water	...	...	1 oz.
(92) Borax	...	...	10 grs.
Water	...	...	1 oz.
(93) Alum	...	...	4 grs.
Water	...	...	1 oz.

A small quantity to be syringed gently into the eye three or four times a day. Weak solutions such as the above can do no harm.

(b) To relieve pain.

This may be added to any of the above in this strength, that is, 5 grs. of extract of belladonna to the ounce.

(94) Extract of belladonna	...	...	5 grs.
Water	...	...	1 oz.
(95) Extract of belladonna	...	...	2 drs.
Water	...	...	1 dr.
Glycerine	...	...	$\frac{1}{2}$ oz.

— Rub the extract down with water, then add the glycerine and mix well together. This may be applied by rubbing it into the skin around the eye. (Most useful when there is much pain.)

(c) Eye ointment.

(96) Yellow oxide of mercury	...	...	1 to 3 grs.
Vaseline	...	...	1 dr.

A small quantity about the size of a split pea is inserted under the upper lid.

(d) Eye powder.

- (97) Calomel, a few grains on a camel's hair brush flicked into the eye once daily. (Particularly useful in ulceration of the cornea.)

Fomentations are local applications of hot water with the object of relieving pain or promoting the healing process in any part by increasing the flow of the blood within it. They may be employed over small areas such as the eye, or extensive areas such as the back. Several gallons of water must be kept heated and when a large surface is to be fomented, such as the belly or chest, a large common or coolly blanket furnished with six ropes, one attached to each corner and one at the centre of each short side, long enough to meet and be secured over the back, is the best method.

Fomentations may be applied in two ways, either (*a*) by first soaking the blanket in water so hot that the hand just bears it, wringing it out thoroughly and applying to the part at once and tying it over the back, a second dry blanket or tarpaulin being placed so as to envelop it and thus retain the heat; or (*b*) as Hawkes recommends, by first securing the *cumbly* or blanket dry, with a layer of straw placed between it and the body. Hot water that the hand will just bear is poured continuously from both sides. A large quantity of water is requisite. Other parts, such as limbs, may be similarly enveloped with pieces of blanket of suitable size. The success of all fomentations depends on the degree and retention of heat: if the water be too hot the skin may be scalded and if not hot enough it is useless in allaying pain. In order to maintain heat, the blanket should be changed at least every ten minutes until the pain is allayed. Everything should be ready prepared, so that the blanket may be clapped on immediately it is wrung out and to do this satisfactorily it is desirable to have at least two blankets in use. The relief of pain locally may be supplemented by sprinkling over the first blanket two or three tablespoonsful of turpentine; this may be repeated once or twice during the day. When the last fomentation is withdrawn, it is necessary to guard against chill by covering the fomented area with a dry blanket for some hours, or by rubbing the part till thoroughly dry, after which some mild

liniment may be applied. At times pain is so severe or deeply seated, or the patient so troublesome to deal with, that local efforts are of little avail and recourse must be had to internal remedies.

Injectiōns are medicines thrown by means of a syringe into cavities, such as abscesses or sinuses, to promote healing or for purposes of cleanliness :—

(98)	Tincture of iodine	...	...	1 to 2 drs.
	Water	...	...	1 pt.
(99)	Nitrate of silver	...	...	2 to 3 grs.
	Water	...	...	1 oz.
(100)	Chloride of zinc	...	...	2 grs.
	Water	...	...	1 oz.
(101)	Sulphate of zinc	...	...	2 to 5 grs.
	Water	...	...	1 oz.
(102)	Alum	...	...	5 grs.
	Water	...	...	1 oz.

Lotions are solutions of drugs intended to be swabbed on to the part, that is without friction ; they are employed for various purposes, such as disinfecting, reducing inflammation, cleansing, etc.—

(a) *Cooling.*

(103)	Rectified or methylated spirit	...	...	1 oz.
	Water	...	...	1 pt.
(104)	Chloride of ammonia	...	...	} 4 ozs. each.
	Nitrate of potash	...	...	
	Water	...	...	
(105)	Acetate of lead	...	...	4 drs.
	Sulphate of zinc	...	...	4 drs.
	Water	...	...	1 qt.
(106)	Acetate of lead	...	...	1 dr.
	Water	...	...	1 pt.

(b) *To relieve pain.*

(107)	Powdered opium	...	...	$\frac{1}{2}$ dr., may be added to 1 pt. of any of the above.
(108)	Extract of belladonna	...	...	1 dr.
	Water	...	...	1 pt.

(c) Astringent, for reducing discharges.

(109)	Alum	...	...	...	5 to 10 grs.
	Water	...	...	...	1 oz.
(110)	Sulphate of zinc	...	...	...	2 to 4 drs.
	Water	...	...	...	1 pt.
(111)	Nitrate of silver	...	...	...	1 gr.
	Water	...	...	...	1 oz.
(112)	Nitric acid (dilute)	...	...	...	2½ drs. } For foul
	Water	...	...	...	8 ozs. } ulcers.
(113)	Sulphate of iron	...	...	...	2 to 4 grs.
	Water	...	...	...	1 oz.

(d) Disinfecting.

(114)	Carbolic acid	...	...	...	8 to 12 grs.
	Water	...	...	...	1 oz., (1-40) to (1-60).
(115)	Phenyle	...	...	...	2 to 4 drs.
	Water	...	...	...	1 oz., (1-40) to (1-60).
(116)	Perchloride of mercury (corrosive sublimite)	...	...	...	5 to 10 grs.
	Water	...	...	...	1 pt., (1-2,000) to (1-1,000).
(117)	Boracic acid	...	...	...	15 to 30 grs.
	Water (boiling)	...	...	...	1 oz.
(118)	Borax	...	...	...	4 to 6 drs.
	Water	...	...	...	1 pt.
(119)	Permanganate of potash*	...	...	...	2 to 4 grs.
	Water	...	...	...	1 pt.
(120)	Thymol	...	...	...	10 grs.
	Water (boiling)	...	...	...	1 pt.

Oils are lubricating agents and soothing applications used in various ways:—

(121)	Carbolic acid	...	...	...	1 part.
	Sweet oil	...	...	...	16 to 20 parts.

[Also used for lubricating the hands and instruments, and dressing wounds.]

* Condy's fluid contains 4 grs. to the ounce.

(122) Camphor	...	...	1 oz.
Methylated spirit or other spirit	...	...	Sufficient to dissolve the camphor.
Oil of turpentine	...	...	2 ozs.
Sweet oil	...	...	4 ozs.

Add the spirit to the camphor and rub down in a mortar till quite dissolved, then add the other ingredients.

A dressing to sores especially useful in keeping away flies* :—

- (123) Neem or margosa oil, also used to keep away flies and for removal of maggots. Crushed leaves of custard apple tree also useful for this purpose.

Carron oil is a very soothing application for burns and scalds :—

(124) Lime water	...	...	} Equal parts.
Olive or sweet oil	...	...	

To be well shaken.

Ointments are greasy preparations of soft consistency, containing a variety of drugs for a variety of purposes :—

(125) Carbolic acid	...	...	1 part.
Vaseline †	...	...	20 to 25 parts.
(126) Boracic acid	...	...	1 part.
Vaseline †	...	...	3 parts.
(127) Oxide of zinc	...	...	1 part.
Vaseline †	...	...	8 parts.
(128) Iodoform	...	...	1 dr.
Oil of eucalyptus	...	...	1 oz.

Heat gently till dissolved, and add paraffin and vaseline of each $2\frac{1}{2}$ ozs. Melt together and stir till cold. Can be obtained at any chemist's and is very useful for keeping flies away.

(129) Iodoform	...	...	1 part.
Vaseline †	...	...	9 parts.
(130) Dikamali ‡	...	...	15 drs.
Beeswax	...	...	15 drs.
Powdered gallnuts	...	...	6 drs.
Gingili oil (hnan-si)	...	...	18 drs.

Boil the gallnuts in the oil, then add the *dikamali*, and when it is melted strain through a cloth; lastly add the wax and stir till cold.—*Hawkes*.

* Spirits of camphor or plain powdered camphor are most useful for the removal of maggots in wounds.

† Lard may be substituted.

‡ The resin of the *Gardenia lucida*, known as *dikamali* in Madras and Rangoon bazaars.

Excellent anti-fly dressing :—

(131)	Resin	...	...	...	8 ozs.
	Beeswax	...	...	...	6 ozs.
	Olive oil	...	...	...	3 ozs.
	Lard	...	...	...	3 ozs.

Melt with gentle heat, strain the mixture while hot through a cloth and stir constantly while cooling.

(132)	Creosote	...	...	...	1 part.
	Vaseline or lard	...	...	...	8 parts.

(133)	Common tar	...	...	...	} Equal parts.
	Resin	...	...	...	
	Lard	...	...	...	

Melt together by gentle heat and stir till cold : a dressing for the feet.

(134)	Sulphate of copper	...	...	...	1 part.
	Alum	...	...	...	1 part.
	Tar	...	...	...	4 parts.

Mix, stir and heat together until the mass assumes a reddish-brown colour.

A dressing especially useful for cracks and fissures about the feet :—

(135)	Iodine	...	...	...	$\frac{1}{2}$ oz.
	Iodide of potash	...	...	...	1 oz.
	Vaseline or lard	...	...	...	8 ozs.

A good application for the dispersion of swellings, enlarged glands, etc.

Paints are fluid applications usually used to promote absorption of swellings or protection of raw surfaces :—

(a) *Protective paint.*

- (136) Sheet gelatine is soaked in sufficient 1 per cent. solution of corrosive sublimate to cover it. When it becomes quite soft, melt by gentle heat and add glycerine equal to $\frac{1}{10}$ th the weight of the dry gelatine added. This gives it an elastic character. To use it, it is melted on a slow fire and painted over a wound, and it adheres equally well to moist or dry surfaces. The surface can be strengthened by laying on it, while moist, shreds of tow or strips of gauze.—*Möller.*

(137)	Carbolic acid	...	...	...	1 oz.
	Camphor	...	...	...	5 ozs.
	Resin or shellac	...	...	...	1 oz.
	Spirits of wine	...	...	...	15 ozs.

—*Hayes.*

Dissolve the camphor and resin in the spirit, then add the carbolic acid and shake well. A protective dressing for wounds and useful to keep away flies. Repeat as occasion requires.

(b) Absorbent.

(138) Liniment of iodine or liniment of double strength applied once every other day, painted on the swelling to be removed. Also see 135.

Poultices.—These are external applications of a soft consistence and act chiefly by virtue of their warmth or moisture. They are soothing, relieve pain and hasten the formation of matter, and are generally made of linseed meal, flour, or bran, and are rendered anodyne by adding a little laudanum, poppy-heads, etc.; deodorizing by adding finely powdered charcoal, and antiseptic with eucalyptus oil, carbolic acid, solution of thymol, creosote, phenyle, etc.

Natives employ poultices of leaves of the *dhatūra* (*Datura alba* or *festuosa*) and *mudar* (*Calotropis gigantea*) plants, and *neem* tree (*Azadirachta Indica*) to irritable painful sores, and also as a stopping for abscesses in elephants.

Hawkes states that the following native application has been found efficacious in expediting the filling up of abscesses with healthy flesh:—

Dhatūra leaves	...	...	40 tolas.
Neem leaves	...	...	40 tolas.
Turmeric	...	...	5 tolas.
Salt	...	...	10 tolas.

Grind all together with a little water and introduce a portion of it into the opened abscess; remove it every second day, wash the cavity out and apply any lotion that may be necessary, and re-stop with the mixture. Owing to the size usually required and the difficulty of retaining poultices in position, fomentations are generally used in preference; they may however be used with advantage to many injuries about the limbs.

Poulticing boots.—These are most useful to keep an injured foot clean: the sole may be made of stout leather or wood, the uppers of ordinary leather; *they should be kept soft with soap or grease.*

Mussauls are composed chiefly of stimulant and digestive spices given in the form of a bolus; other corrective medicines may be added.

The following are some formulæ for *mussauls* usually employed:—

(a) Astringents and anodyne in diarrhœa, colic, etc.

(a) Cardamoms	...	...	2 tolas.
Cinnamon	...	...	2 tolas.
Opium	...	...	1 tola.
Catechu	...	...	2 tolas.
Chalk	...	...	4 tolas.
Jaggery	...	...	10 tolas.
Brandy	...	...	$\frac{1}{4}$ pt.

Repeat every four hours till desired effect is produced.

(b) Opium	...	...	...	3 tolas.
Ginger	...	...	...	4 tolas.
Catechu	...	...	...	2 tolas.
Brandy	...	...	...	$\frac{1}{2}$ pt.

Repeat if necessary according to circumstances.

(c) Opium	...	...	...	} 5 drs. of each.
Assafœtida	...	...	...	
Ginger	...	...	...	
Nutmeg	...	...	...	
Jaggery	...	...	...	2 ozs.
Brandy	...	...	...	$\frac{1}{4}$ pt.

Repeat dose if necessary in two hours.

(b) *For catarrh.*

(d) Bdellium (resin from Balsamodendron agalochia)	...	...	...	3 tolas.
Mustard seed	...	...	...	3 tolas.
Turmeric	...	...	...	3 tolas.
Assafœtida	...	...	...	4 tolas.
Borax	...	...	...	3 tolas.

Add sufficient wheat flour to make three pills : one night and morning.

(c) *Fever.*

(e) Aconite leaves (powdered)	...	...	...	1 tola.
Calomel	...	...	...	2 tolas.
Jaggery	...	...	...	20 tolas.

Divide into eight pills : one to be given every night.

(f) (1) Nitre	...	...	...	2 tolas.
(2) Camphor	...	...	...	1 tola.
(3) Darchob (Berberis aristata)	...	...	...	3 tolas.
(4) Jaggery	...	...	...	6 tolas.
(5) Vinegar	...	...	...	$\frac{1}{2}$ pt.

Rub Nos. (2) and (4) together, make (3) into a fine powder, add (1) and (5), and mix the whole well; place in a piece of plantain leaf and give. Dose to be repeated three times a day.

This is also a strong diuretic :—

(g) Sour milk	...	...	...	4 lbs.
Onions	...	...	...	$1\frac{1}{2}$ lbs.
Green ginger	...	...	...	$\frac{1}{2}$ lb.
Saltpetre	...	...	...	2 tolas.
Jaggery	...	...	...	1 lb.
Ghee	...	...	...	1 qt.

—Harokes.

A cooling *mussaul*. Give every morning for three successive days.

(h) Tartar emetic	...	...	...	2 drs.
Aconite leaves	...	...	...	2 drs.
Wheat flour	...	...	...	} A sufficiency.
Ghee	...	...	...	

—Steel.

Mix and make into a pill. This *mussaul* is given as a sedative in fever, etc.

CHAPTER IV.

LIST OF USEFUL DRUGS IN THE TREATMENT OF ELEPHANTS—DRUGS WITH THEIR DOSES AND EQUIVALENT NATIVE NAMES, ETC.

A List of Useful Drugs to be kept in Sick Elephant Camps.

(All drugs and instruments should be kept under lock and key.)

	lb. oz.		lb. oz.
Acid, acetic, dilute (vinegar) ...	1 0	Hydrargyri iodidum rubrum (red iodide of mercury).	0 2
Acid, arsenious (white arsenic) ...	0 4	Iodoform ...	0 4
Acid, boracic ...	4 0	Iodine, liniment of ...	0 4
Acid, carbolic ...	2 0	Iodide of potash ...	0 4
Acid, nitric (strong) ...	0 8	Indian hemp { Bhang ...	0 8
Aloes, barb. ...	2 0	{ Ganja ...	0 8
Alum ...	2 0	Nitrate of potash (nitre) ...	2 0
Ammonia, liquor (strong) ...	1 0	Nitrate of silver (lunar caustic)	0 1
Antimonium tart. (tartar emetic).	0 4	Nux vomica (powdered) ...	1 0
Arsenicalis, liquor ...	1 0	Oil, croton ...	0 4
Belladonna (extract) ...	0 4	Oil, ricini (castor oil) ...	3 0
Bicarbonate soda ...	1 0	Oil, lini (linseed oil) ...	3 0
Camphor ...	1 0	Oil, turpentine ...	4 0
Cantharides ...	0 4	Opium ...	1 0
Catechu (cutch) ...	4 0	Phenyle ...	2 0
Chiretta ...	4 0	Pix liquida (tar) ...	4 0
Cinchona bark (powdered) ...	1 0	Plumbi acetas (sugar of lead)	1 0
Corrosive sublimate ...	0 8	Soap, soft ...	2 0
Creta præparata (prep. chalk)	4 0	Soap, hard ...	1 0
Cupri sulphas (blue-stone) ...	1 0	Spirits, ætheris ...	1 0
Datura leaves ...	0 2	Spirits, ætheris nitrosi (sweet spirits of nitre).	1 0
Datura seeds ...	0 1	Sulphur, sublimed ...	1 0
Epsom salts ...	10 0	Tincture of aconite (B.P.) ...	0 1
Ferri sulphas (sulphate of iron)	2 0	Tincture of iodine ...	0 4
Gallic acid ...	0 8	Vaseline ...	2 0
Gentian ...	4 0	Zinci oxide ...	0 4
Glycerine ...	0 8	Zinci sulphas ...	0 4
Hioscyamus leaves ...	0 1		

Drugs that can be procured in a pure state from the Bazaar.

Ammonia chloride.	Assafoetida.	Cardamoms.
Allspice.	Caraway.	Chiretta.
Aniseed.	Capsicum.	Cinnamon.

Drugs that can be procured in a pure state from the Bazaar
—concluded.

Cloves.	Gum arabic.	Pepper (long).
Cocoanut oil.	Jaggery.	Salt, common.
Coriander.	Linseed meal.	Sesamum oil.
Cummin.	Mustard.	Soap, bar.
Dikamali.	Mutton fat (or lard).	Tamarind.
Garlic.	Nutmegs.	Treacle.
Ghee.	Oil of mustard.	Turmeric.
Ginger.	Pepper (black).	Blankets for fomentation.

List of Drugs employed in the Treatment of Elephants, with their Native Names, Actions, Uses, and Doses.*

Drugs.	Hindustani.	Burmese.	Uses.		Doses.			Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	
Abrus precatorious leaves	Gunchi	ဝဇ္ဇိန္ဒူ	...	Root and leaves yield extract like liquorice. Bruised leaves to swellings as a suppurative and detergent, specially indicated in blind boils— <i>Steel</i>	...	...	...	Used instead of liquorice root— <i>Steel</i>
Acacia gummi	Goond, Babul— <i>Steel</i>	ခရီးချက်	Dermulic— <i>Steel</i> , <i>Slymm</i> . In diarrhoea— <i>Dun</i>	Emollient ...	<i>Ad lib.</i>	1 to 4 seeds	...	<i>Ad lib.</i>
Acacia gummi (mucilage)	...	...	Do.	Do.	...	...	...	...
Acetate of morphia	...	...	...	Anodyne, eye lotion	...	...	...	Vinegar
Acetum	Sirka	ပိုးရည်	Refrigerent— <i>Steel</i> . As- tringent, diuretic, styptic — <i>Tuson</i>	Rubefacient, antiseptic— <i>Steel</i> . Cooling— <i>Tuson</i> . Stimulant— <i>Finlay Dun</i>	About $\frac{1}{2}$ pint	...	...	...
Acid arseniosum	Sufed sunbul— <i>Steel</i> , So- mul— <i>Slymm</i>	မိန့်ပြု	Alterative, tonic— <i>Steel</i> . In chronic rheumatism— <i>Tuson</i>	Caustic— <i>Steel</i>	...	6 to 20 grains	10 to 30 grains	White arsenic
Acid boracic	...	...	...	In wounds and burns; antiseptic	...	...	...	...
Acid boracic lotion	...	...	...	Do.	...	...	...	...
Acid boracic ointment	...	...	...	Do.	...	...	...	...
Acid, carbolic	...	...	In anthrax— <i>Steel</i> , Anthel- mintic— <i>Slymm</i> , <i>Tuson</i>	Caustic, disinfectant, as- tringent, styptic— <i>Tuson</i>	About 2 drs.	...	...	2 drs. (well diluted)
Acid carbolic lotion	...	...	...	Washing and cleansing, disinfecting wounds, hands; instruments, car- casses, etc.	...	...	...	...
Acid carbolic oil	...	...	...	Dressing for wounds, sores and ulcers	...	...	...	...

Acid carbolic ointment	...	...	Dressing for wounds, sores and ulcers. To sloughing and unhealthily wounds— <i>Tuon</i>	...	...	1 to 2 drs.	
Acid, gallic	...	...	Astringent, styptic— <i>Tuon</i>	...	...	...	
Acid, nitric	...	...	...	...	...	...	
Acid, nitric (dilute)	Shora ka tezab	ယမ်း ပိန်း ထောင်ခွေး	Tonic, astringent— <i>Tuon</i> . In chronic skin and liver diseases— <i>Tuon</i>	Caustic, deodorizer, disinfectant— <i>Tuon</i>	...	1 to 3 drs.	Given in a bucket of water
Acid, tannic	...	...	Astringent, styptic— <i>Tuon</i>	Astringent, styptic— <i>Tuon</i>	...	1 to 2 drs.	Aconitum napellus
Aconite leaves	Atis, batch-nagh— <i>Steel</i> . Bish (bikh), batch naag— <i>Slymin</i>	ဆီးခွေးထောင်	Sedative— <i>Steel</i> , <i>Slymin</i> , <i>Tuon</i> . Anodyne— <i>Tuon</i>	Anodyne; allays rheumatic pains— <i>Tuon</i>	1 to 1 tola	1 to 2 drs.	
Aconite, tincture	...	...	Sedative— <i>Tuon</i> . In fevers	Anodyne— <i>Tuon</i>	...	20 to 30 drops	If Fleming's tincture instead of British Pharmacopoeia preparation is used, dose 5 to 10 drops
Adeps, preparata	Churbi— <i>Steel</i>	ဝတ်ဆီ	...	Vehicle— <i>Steel</i> . Dressing to blistered surfaces, and protects parts from the irritating action of acrid discharges, used in preparation of various ointments	...	...	Lard
Aether	...	...	Stimulant, narcotic, antispasmodic— <i>Tuon</i>	Refrigerant— <i>Tuon</i>	...	1 to 2 ozs.	Sulphuric aether given in fatigue in an enema
Aether, nitrous	...	...	Diffusible stimulant— <i>Steel</i> . Anti-spasmodic, diuretic, diaphoretic	...	4 ozs.	3 to 4 ozs.	Spirits aether nitrati. (Sweet spirits of nitre)
Albumen, egg	...	ကျက်ဥဆီ	Nutrient; antidote to corrosive poisons	...	...	...	White of egg
Allspice	...	...	See Pimento	...	...	...	

* The "Materia Medica Veterinaria Indica" (Indian Veterinary Manuals), Part I, by Veterinary Surgeons Steel and Symonds, A.V.D., published by the Lawrence Asylum Press, Madras, contains valuable information on Indian drugs, their actions and uses and is strongly recommended for ready reference.

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	—	
Abrus precatorious leaves	Gundhi ...	ဝဇ္ဇန်းဝေ	...	Root and leaves yield extract like liquorice. Bruised leaves as a suppurative and detergent, specially indicated in blind boils— <i>Steel</i>	...	...	...	...	Used instead of liquorice root— <i>Steel</i>
Acacia gummi ...	Goondi, Babul— <i>Steel</i>	ခေါင်းရွက်	Demulcent— <i>Steel, Slymm.</i> In diarrhoea— <i>Dun</i>	Emollient ...	<i>Ad lib.</i>	1 to 4 scers	...	<i>Ad lib.</i>	
Acacia gummi (mucilage)	...	...	Do.	Do.					
Acetate of morphia	...	...	...	Anodyne, eye lotion					
Acetum ...	Sirka ...	ပိုးရည်	Refrigerant— <i>Steel.</i> As- tringent, diuretic, styptic— <i>Tyson</i>	Rubefacient, antiseptic— <i>Steel.</i> Cooling— <i>Tyson.</i> Stimulant— <i>Finsky Dun</i>	About ½ pint	...	...	4 ozs.	Vinegar
Acid arseniosum ...	Sufed sunbul— <i>Steel, So-mul—Slymm</i>	စိန်ပြာ	Alterative, tonic— <i>Steel.</i> In chronic rheumatism— <i>Tyson</i>	Caustic— <i>Steel</i> ...	...	6 to 30 grains	10 to 30 grains	4 to 6 grains	White arsenic
Acid, boracic ...	...	...	...	In wounds and burns; antiseptic					
Acid boracic lotion	...	...	...	Do.					
Acid boracic ointment	...	...	...	Do.					
Acid, carbolic ...	...	...	In anthrax— <i>Steel.</i> Anthel- mintic— <i>Slymm, Tyson</i>	Caustic, disinfectant, as- tringent, styptic— <i>Tyson</i>	About 3 drs.	...	...	2 drs. (well diluted)	
Acid carboic lotion	...	...	...	Washing and cleansing, disinfecting wounds, hands; disinfecting sheds, instruments, car-casses, etc.					
Acid carboic oil ...	...	...	...	Dressing for wounds, sores and ulcers					

Acid carboic ointment	...	...	...	Dressing for wounds, sores and ulcers. To sloughing and unhealthy wounds— <i>Tyson</i>	...	...	...	1 to 2 drs.	
Acid, gallic ...	...	...	Astringent, styptic— <i>Tyson</i>	Astringent, styptic— <i>Tyson</i>	...	...	...	1 to 2 drs.	
Acid, nitric ...	Shora ka tezah— <i>Steel</i>	...	...	Caustic— <i>Steel.</i> Deodorizer, disinfectant— <i>Tyson</i>	...	...	...	1 to 3 drs.	Given in a bucket of water
Acid, nitric (dilute)	Shora ka tezah	ယင်း ဝိုင်း	Tonic, astringent— <i>Tyson.</i> In chronic skin and liver diseases— <i>Tyson</i>	Caustic, deodorizer, disinfectant— <i>Tyson</i>	...	...	...	1 to 2 drs.	
Acid, tannic ...	...	ထောင်စိမ်း	Astringent, styptic— <i>Tyson</i>	Astringent, styptic— <i>Tyson</i>	...	...	...	1 to 2 drs.	
Aconite leaves ...	Atis, butch-nagh— <i>Steel.</i> Biso (akhi), butch naag— <i>Slymm</i>	ခမ်းထောင့်	Sedative— <i>Steel, Slymm, Tyson.</i> Anodyne— <i>Tyson</i>	Anodyne; allays rheumatic pains— <i>Tyson</i>	Doubtful	½ to 1 tola	...	½ to 2 dr.	Aconitum napellus
Aconite, tincture ...	...	...	Sedative— <i>Tyson.</i> In fevers	Anodyne— <i>Tyson</i> ...	...	...	...	20 to 30 drops	If Fleming's tincture instead of British Pharmacopoeia preparation is used, dose 5 to 10 drops
Adeps, præparata	Charhi— <i>Steel</i>	ဝက်ဆီ	...	Vehicle— <i>Steel.</i> Dressing to blistered surfaces, and protects parts from the irritating action of acrid discharges, used in preparation of various ointments	...	...	...	...	Lard
Aether ...	...	...	Stimulant, narcotic, antispasmodic— <i>Tyson</i>	Refrigerant— <i>Tyson</i> ...	...	...	...	1 to 3 ozs.	Sulphuric aether given in fatigue in an enema
Aether, nitrous ...	...	...	Diffusible stimulant— <i>Steel.</i> Anti-spasmodic, diuretic, diaphoretic	...	4 ozs.	...	...	3 to 4 ozs.	Spirite aether nitrosi. (Sweet spirits of nitre)
Albumen, egg ...	...	ကျက်ဥအကော	Nutrient; antidote to corrosive poisons	...	...	...	...	...	White of egg
Allspice ...	...	...	See Pimento						

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List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	USES.		DOSES.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.		
Aloes, Barbadoes ...	Moosabbar, ilva— <i>Steel</i>	မုတ်	Purgative, Diuretic, <i>Tuson</i>	tonic— <i>Steel</i> . vermituge— <i>Tuson</i>	Stimulant to wounds and ulcers— <i>Steel</i>	1 oz.	...	...	Inspissated juice of the leaf of <i>aloe vulgaris</i> — <i>Tuson</i>
Aloes Barbadoes, enema	...	...	...	...	In constipation, colic, worms, etc.	...	...	...	
Alum	Phitkari— <i>Steel</i> . Phutkee— <i>Slymm</i>	ကျောက်ချည်	Astringent— <i>Steel</i> , <i>Slymm</i> . Used as tonic by natives — <i>Slymm</i> . In obstinate diabetes— <i>Tuson</i>	Astringent— <i>Steel</i> , <i>Slymm</i> . — <i>Slymm</i> . In obstinate diabetes— <i>Tuson</i>	Astringent— <i>Steel</i> . Syptic, collyrium— <i>Tuson</i>	...	1 to 4 tolas	...	2 drs.
Alum, burned	...	ကျောက်ချည် ထွေဝါ။	...	...	Caustic, astringent— <i>Tuson</i>	...	...	...	Dried alum
Alum lotion	...	ကျောက်ချည် ရေ။	...	...	Astringent in washing wounds, galls (hardening), eye-wash, washing sinuses, etc.	...	...	...	
Ammonia chloride	Nowsagar— <i>Steel</i>	ရဝဝဝဝ	Liver stimulant— <i>Steel</i> . Alterative, absorbent— <i>Slymm</i>	Refrigerant— <i>Steel</i> . Stimulant to sprains and swellings.	...	1 to 3 ozs.	...	...	Sal ammoniac
Ammonia liniment	...	...	...	...	Counter-irritant in sore-throat, rheumatism, sprains, etc.— <i>Tuson</i>	...	...	...	
Ammonia liniment, comp.	...	...	...	...	Counter-irritant in sore-throat, rheumatism, sprains, etc., but more active	...	...	...	Ad lib.
Amylum	...	ကလီ	Demulcent, emollient— <i>Tuson</i> . In the form of gruel	When dusted it diminishes discharge from wounds	...	...	...	...	Starch, when mixed with hot water used in enemata
Aniseed	Sonf— <i>Slymm</i> . Noanisoo— <i>Khory</i>	စပုနီဝါး	Carminative Stomachic, aromatic— <i>Tuson</i>	...	...	...	8 to 30 tolas	...	Fruit of pimpinella anisum— <i>Khory</i>

Anti-dysenterica bark	...	ဝေခနာဝပ်နီ	...	Diuretic, anodyne, stimulant— <i>Khory</i> . Tonic, febrifuge; in dysentery— <i>Steel</i>	...	...	...	...	Wrightia tinctoria— <i>Steel</i> . Holarrhena anti-dysenterica— <i>Khory</i>
Anti-dysenterica seeds	Inderjou	...	လဝင်ထုတ်ဝပ်နီ	Astringent, stimulant, corrective— <i>Steel</i> . Tonic, anti-dysentery— <i>Synn</i> . Anthelmintic, febrifuge. In chronic chest diseases— <i>Khory</i>	...	2 to 4 tolas	1 to 4 tolas	$\frac{1}{2}$ oz.	...
Antimony	Soorma	...	...	Alterative— <i>Synn</i>	...	$\frac{1}{2}$ to 1 oz.	$\frac{1}{2}$ to 3 tolas	...	Sulphuret of lead— <i>Khory</i>
Antimony tart.	...	...	...	Sedative— <i>Steel</i> . Alterative, vermifuge, antiphlogistic— <i>Synn</i>	Stimulant— <i>Steel</i> . Counter-irritant, vesicant— <i>Synn</i>	...	1 to 2 drs.	2 drs.	Tartar emetic
Arca-nut	Soopari	...	ထွင်းဝါး	Astringent, anthelmintic— <i>Synn</i>	Astringent— <i>Synn</i>	...	...	...	...
Argenti nitras	Kari khar— <i>Steel</i> . Kab-dee kahri kohrum— <i>Synn</i>	...	...	...	Caustic— <i>Steel</i> . Stimulant, astringent— <i>Synn</i> . Applied to poisoned wounds and bites of rabid animals and venomous snakes	...	...	...	Behenut, seeds of the fruit of arca-nut— <i>Synn</i> . Lunat caustic
Arrack	Daroo— <i>Steel</i> . Sharab	...	ဒဂုဂ်	Stimulant— <i>Steel</i> . Antispasmodic— <i>Steel</i> . Diaphoretic, diuretic, expectorant— <i>Finlay Dun</i>	Irritant, refrigerant, antiseptic— <i>Finlay Dun</i>	1 to 2 pints	1 to 2 seers	8 to 12 ozs.	Repeated when necessary
Arsenicallis liq.	...	...	...	...	...	...	...	$\frac{1}{2}$ to 1 oz.	...
Assafetida	Hing	...	ရှိန်းဂို	Anti-spasmodic, stimulant, vermifuge— <i>Steel</i> , <i>Synn</i> . Expectorant in cough— <i>Synn</i>	...	$\frac{1}{2}$ to 2 ozs.	1 to 2 tolas	1 to 1½ ozs.	Resin obtained by incision from the living root of nardus assafetida— <i>Synn</i>
Assafetida enema	...	...	...	...	...	...	...	...	...
Bael fruit	Bil patri— <i>Steel</i> . Bil or siphai— <i>Steel</i>	...	ဆုဂ်ရှင်ဝါး	Intestinal stimulant in diarrhoea and dysentery— <i>Steel</i>	...	...	...	Several fruit	Bengal quince, cratena religiosa or agle mar-melos
Balbarung berries	Balbarung	...	ဆိပ်ရွှေဝါး	Anthelmintic, tonic, excitant— <i>Steel</i>	...	...	2 to 6 tolas	6 ozs.	Embellia (berries)
Bamboo leaves	Baass ka putta	...	ဝါရွှေဂ်	Nutritive, demulcent; useful in chronic cough— <i>Steel</i>	...	...	...	Ad lib.	Bambusa arundinacea and others

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	Uss.		Doses.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	—	
Aloes, Barbadoes ...	Moosabbar, <i>ilva</i> — <i>Steel</i>	မုတ် ...	Purgative, tonic— <i>Steel</i> , Diuretic, vermifuge— <i>Tuson</i>	Stimulant to wounds and ulcers— <i>Steel</i>	1 oz.	...	...	$\frac{1}{2}$ to 1 oz.	Impassated juice of the leaf of aloes vulgaris— <i>Tuson</i>
Aloes Barbadoes, enema	...	...	...	In constipation, colic, worms, etc.	...	...	...	...	...
Alum ...	Phitkari— <i>Steel</i> , Phutkee— <i>Slymm</i>	ကျောက်ချည်	Astringent— <i>Steel</i> , <i>Slymm</i> . Used as tonic by natives— <i>Slymm</i> . In obstinate diabetes— <i>Tuson</i>	Astringent— <i>Steel</i> . Styptic, collyrium— <i>Tuson</i>	...	1 to 4 tolas	...	2 drs.	...
Alum, burned ...	...	ကျောက်ချည် ကျွမ်း	...	Caustic, astringent— <i>Tuson</i>	...	...	...	...	Dried alum
Alum lotion ...	...	ကျောက်ချည် ရေ	...	Astringent in washing wounds, galls (hardening), eye-wash, washing sinuses, etc.	...	...	...	...	...
Ammonia chloride	Nowasagar— <i>Steel</i>	ကဝင်သာ ...	Liver stimulant— <i>Steel</i> , Alternative, absorbent— <i>Slymm</i>	Refrigerant— <i>Steel</i> . Stimulant to sprains and swellings.	1 to 3 ozs.	...	...	$\frac{1}{2}$ to 1 $\frac{1}{2}$ ozs.	Sal ammoniac
Ammonia liniment	...	...	...	Counter-irritant in sore-throat, rheumatism, sprains, etc.— <i>Tuson</i>	...	...	...	...	...
Ammonia liniment, comp.	...	...	...	Counter-irritant in sore-throat, rheumatism, sprains, etc., but more active	...	...	...	...	...
Amylum ...	...	တပိ	Dermulcent, emollient— <i>Tuson</i> , In the form of gruel	When dusted it diminishes discharge from wounds	...	...	...	<i>Ad lib.</i>	Starch, when mixed with hot water used in enemias
Aniseed ...	Soni— <i>Slymm</i> , Noanisoo— <i>Khory</i>	မုန့်ပေး	Carminative — <i>Slymm</i> , Stomachic, aromatic— <i>Tuson</i>	...	...	8 to 30 tolas	...	1 to 2 ozs.	Fruit of pimpinella anisum— <i>Khory</i>
Anti-dysenterica bark	...	ခနောက်ပိန်	Diuretic, anodyne, stimulant— <i>Khory</i> . Tonic, febrifuge; in dysentery— <i>Steel</i>	...	...	...	...	...	Wrightia tinctoria— <i>Steel</i> , Polar-rhena anti-dysenterica— <i>Khory</i>
Anti-dysenterica seeds	Inderjou ...	ဝက်ထုတ်ပိန်	Astringent, stimulant, corrective— <i>Steel</i> Astringent, tonic, anti-dysenteric— <i>Slymm</i> Anticholimetic, febrifuge. In chronic chest diseases— <i>Khory</i> Alternative— <i>Slymm</i>	...	$\frac{1}{2}$ to 1 oz.	2 to 4 tolas	1 to 4 tolas	$\frac{1}{2}$ oz.	...
Antimony ...	Soorma ..	...	Sedative— <i>Steel</i> . Alternative, vermifuge, antiphlogistic— <i>Tuson</i>	Stimulant— <i>Steel</i> . Counter-irritant, vesicant— <i>Tuson</i>	...	$\frac{1}{2}$ to 3 tolas	...	...	Sulphuret of lead— <i>Khory</i>
Antimony tart.	...	...	...	...	...	...	1 to 2 drs.	2 drs.	Tartar emetic
Areca-nut	Soopari ...	ကွင်းဝါး	Astringent, anthelmintic— <i>Tuson</i>	Astringent— <i>Slymm</i>	...	...	...	...	Betelnut; seeds of the fruit of areca catechu— <i>Tuson</i> Lunar caustic
Argenti nitras	Kari khar— <i>Steel</i> , Kah-dee kahri kahrum— <i>Slymm</i>	...	...	Caustic— <i>Steel</i> , <i>Slymm</i> . Stimulant, astringent— <i>Tuson</i> . Applied to poisoned wounds and bites of rabid animals and venomous snakes	...	...	...	...	...
Arrack	Daroo— <i>Steel</i> , Sharab	အရက်	Stimulant— <i>Steel</i> . Antispasmodic— <i>Steel</i> . Diaphoretic, diuretic, expectorant— <i>Finlay Dun</i>	Irritant, refrigerant, antiseptic— <i>Finlay Dun</i>	1 to 2 pints	1 to 2 seers	...	8 to 12 ozs.	Repeated when necessary
Arsenicis liq. ...	...	...	...	...	...	...	...	$\frac{1}{2}$ to 1 oz.	...
Assafetida	Hing ...	ဂျိန်ဒို	Anti-spasmodic, stimulant, vermifuge— <i>Steel</i> , <i>Slymm</i> . Expectorant in cough— <i>Tuson</i>	...	$\frac{1}{2}$ to 2 ozs.	1 to 3 tolas	...	1 to 1 $\frac{1}{2}$ ozs.	Resin obtained by incision from the living root of narthex assafetida— <i>Tuson</i>
Assafetida enema	...	...	...	...	...	...	...	...	...
Bael fruit	Bil patri— <i>Steel</i> , Bil or siphali— <i>Steel</i>	အလ်ရှင်သီး	Intestinal stimulant in diarrhoea and dysentery— <i>Steel</i>	...	...	...	...	Several fruit	Bengal quince, cratzna religiosa or agrie marmelos
Balbarung berries	Balbarung ...	အိမ်သွယ်သီး	Anthelmintic, tonic, excitant— <i>Steel</i>	...	...	2 to 6 tolas	2 to 6 tolas	6 ozs.	Embellia (berries) ribes
Bamboo leaves	Banes ka putta	ဝါးရှက်	Nutritive, demulcent; useful in chronic cough— <i>Steel</i>	...	...	...	...	<i>Ad lib.</i>	Bambusa arundinacea and others

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	USES.		DOSES.				Remarks.
			Internal.	External.	Steel.	Symm.	Gilchrist.	—	
Barbalion	...	မရမ်းဝေး	Purgative	...	...	...	...	2½ drs.	
Bellidium	...	ဆူးဝေ	Stimulant, aromatic— <i>Steel</i> . Tonic— <i>Symm</i> . Demul- cent, aperient, alterative, cordial, and stimulant— <i>Khory</i>	Stimulant for indolent and ill-conditioned ulcers— <i>Symm</i>	½ to 1 oz.	1 to 3 tolas	...	½ to 1 oz.	Gum resin from balamodendron mukul— <i>Khory</i>
Belladonna extract	...	...	Sedative, anodyne, anti- spasmodic in cough— <i>Tum</i>	Anodyne in muscular spasms as in tetanus or ophthalmia, etc.	...	...	...	½ to 1½ drs.	<i>Atropa belladonna</i> (deadly night- shade)
Benzoin	...	လောင်တန်	Stimulant— <i>Steel</i> . Anti- spasmodic— <i>Symm</i> Ex- pectorant— <i>Symm</i>	Excitant to wounds— <i>Tum</i>	½ to 1 oz.	2 to 6 tolas	...	...	Balsamic resin from styrax ben- zoin— <i>Tum</i>
Betelnut	...	...	<i>Pide</i> Areca-nut						
Bhang	...	ယောဒြောင်	See Indian hemp	...	...	2 to 4 tolas	...	5 to 10 drs.	Leaves of cannabis sativa, var. indica
Bheia	...	ချီးဝီး	Stimulant, excitant— <i>Steel</i>	Stimulant, caustic, vesi- cant— <i>Steel</i>	½ to 1 oz.	...	2 to 8 tolas	...	Marking nut, Ma- daga, var. indica marsh-nuts, fruits of. Semecarpus anacardium
Bismuth, subnitrate	...	...	Sedative, mild tonic	Desiccant, astringent— <i>Finlay Dun</i>	...	...	...	3 drs.	
Borax	...	ဝက်ဖြား	...	Mild Detergent, astringent, collyrium	...	1 to 4 tolas	...	...	Sodium borate; sodium baborate
Bonduc (nuts)	...	ကလိပ်တိး	Powerful tonic, excitant, antihelmintic, deobstru- cut, emmenagogue, astringent, and pectoric <i>Steel</i> . In worms, lun- gun, liver disorders, diarrhoea, and debility	Discutient, inflamed and swollen joints; ground in castor-oil	2 to 8 tolas	2 to 6 tolas	...	1 to 2 ozs.	Guilandina bonduc

Brandy	...	Brandy sharab	...	See Arrack	...	...	...	...	...	8 to 12 ozs.	Well diluted
Butea seed	...	Palas papra, palas ka binj	...	Anthelmintic	...	...	...	...	...	½ oz.	Butea frondosa ; good for removal of worms
Calotropis gigantea root	...	Aak ka jur, mudar	...	Narcotic ; in small doses, alterative, tonic, emetic (large doses) ; restores tone to bowels in cases of flatulency ; diarrhoea and dysentery Do.	Vesicant (juice), anodyne, detergent	About 3 drs.	1 to 6 tolas	2 to 6 tolas	...	...	Mudar root
Calotropis gigantea flowers	...	Aak ka phul ...	...	...	Vesicant ; cleanses foul ulcers— <i>Gilchrit</i>	...	2 to 6 tolas	...	...	...	Mudar flowers
Calomet	...	Ras kapur— <i>Steel</i> , Para ka khan— <i>Slymm</i>	...	Alterative— <i>Steel</i> , <i>Slymm</i> . Aperient— <i>Steel</i> . Cathar- tic, sedative, diaphoretic, anthelmintic, diuretic in liver diseases Anti-spasmodic, narcotic— <i>Steel</i> . Stimulant, seda- tive in chronic cough— <i>Tuson</i>	Caustic— <i>Steel</i> . Flicked in eye in opacity of cornea	½ to 1 dr.	½ to 2 tolas	...	½ to 1½ drs.	...	Care should be ex- ercised with this drug ; commence with ½ dr.
Camphor	...	Kapoor, kafur — <i>Steel</i>	...	...	...	5 drs. to 3 ozs.	2 to 4 tolas	...	2 to 6 drs.	...	...
Camphor lint. comp.	...	...	...	...	Counter-irritant in sprains, rheumatism, bronchitis, and swellings ; stimulant	...	...	...	...	...	...
Camphorated oil	...	...	...	...	Dressing for wounds, keeps off flies, anti-maggots, stimulant, antiseptic and for removal of maggots	...	...	...	...	...	Spanish flies
Cantharidis ointment	...	...	...	...	Vesicant, counter-irritant, rube-facient	...	...	...	...	...	Capsicum fastigia- tum ; chillies
Capsicums	...	Mirch— <i>Steel</i>	...	Stimulant— <i>Steel</i> , <i>Slymm</i> . Carminative— <i>Tuson</i>	Rubefacient, vesicant— <i>Tuson</i>	2 drs.	2 to 6 tolas	...	...	...	Charcoal
Carbo ligni	...	...	...	In dyspepsia and flatulency and diarrhoea— <i>Tuson</i> . Antidote to aconite strychnia	Deodorizer, disinfectant, vesicant to unhealthy wounds and ulcers. In poultices	...	...	...	...	...	...
Cardamoms	...	Ilachi— <i>Steel</i>	...	Aromatic, stimulant— <i>Steel</i> . Carminative— <i>Slymm</i>	...	½ to 1 oz.	6 to 12 tolas	...	...	...	Elettaria cardamo- mum
Caraway seeds	...	Omam— <i>Steel</i> . Jeera sufaid — <i>Slymm</i>	...	Stimulant— <i>Steel</i> . Carmi- native— <i>Slymm</i> . Stom- achic, aromatic	...	½ to 1 oz.	6 to 12 tolas	...	...	...	Carum carui

List of Drugs employed in the Treatment of Elephants—continued.

144

A TREATISE ON ELEPHANTS.

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	—	
Barballon ...	...	မရင်းဝေး ...	Purgative ...	...	...	...	...	2½ drs.	
Bellium ...	Geogul— <i>Steel</i> . Sala, sallaki — <i>Khory</i>	ဆူးဝေ ...	Stimulant, aromatic— <i>Steel</i> . Tonic— <i>Slymm</i> . Demul- cent, aperient, alterative, cordial, and stimulant— <i>Khory</i>	Stimulant for indolent and ill-conditioned ulcers— <i>Slymm</i>	½ to 1 oz.	1 to 3 tolas	...	½ to 1 oz.	Gum resin from bal-amodendron makul— <i>Khory</i>
Belladonna extract ...	...	...	Sedative, anodyne, anti- spasmodic in cough— <i>Tuon</i>	Anodyne in muscular spasms as in tetanus or ophthalmia, etc.	...	...	...	½ to 1½ drs.	Atropa belladonna (deadly night- shade)
Benzoin ...	Lauhan ...	လောင်တန် ...	Stimulant— <i>Steel</i> . Anti- spasmodic— <i>Steel</i> . Ex- pectorant— <i>Slymm</i>	Excitant to wounds— <i>Tuon</i>	½ to 1 oz.	2 to 6 tolas	...	...	Balsamic resin from styrax ben- zoin— <i>Tuon</i>
Betelnut ...	...	...	<i>Pile</i> Arca-nut	...	...	...	...	...	
Bhang ...	Bhang— <i>Steel</i>	ဆေးခြောက် ...	See Indian hemp ...	...	...	2 to 4 tolas	...	3 to 10 drs.	Leaves of cannabis sahna, var. Indica
Bhela ...	Bhelamay (marking nuts)	ချီးသီး ...	Stimulant, excitant— <i>Steel</i>	Stimulant, caustic, vesi- cant— <i>Steel</i>	½ to 1 oz.	...	2 to 8 tolas	...	Marking nut, Ma- lacca beans, marsh nuts, fruits of. Semecarpus anacardium
Bismuth, subnitrate ...	...	...	Sedative, mild tonic ...	Desiccant, astringent— <i>Finlay Dun</i>	...	...	...	3 drs.	
Borax ...	Sohaga ...	လက်ခြား ...	...	Mild stimulant— <i>Steel</i> . Detergent, astringent, collyrium	...	1 to 4 tolas	...	...	Sodium borate; sodium biborate
Bondue (nuts) ...	Rat karanj, nata karanja gudge kai — <i>Slymm</i>	ကလိပ်သီး ...	Powerful tonic, excitant, nathelmintic, deobstru- ent, emmenagogue, astringent, anti-periodic — <i>Steel</i> . In worms, lung- gun, liver disorders, diarrhea, and debility	Discutient, inflamed and swollen joints; ground in castor-oil	2 to 8 tolas	2 to 6 tolas	...	1 to 2 ozs.	Guilandina bondue

LIST OF DRUGS.

145

Brandy ...	Brandy sharab ...	...	See Arrack ...	...	...	...	...	8 to 12 ozs.	Well diluted
Butea seed ...	Palas papra, palas ka bin)	ပေါက်ပွေ ...	Anthelmintic ...	...	½ oz.	2 to 8 tolas	...	½ oz.	Butea frondosa; good for removal of worms
Calotropis gigantea root ...	Aak ka jur, mudar	မရိုးမြင် ...	Narcotic; in small doses, alterative, tonic, emetic (large doses); restores tone to bowels in cases of flatulency; diarrhea and dysentery	Vesicant (juice), anodyne, detergent	About 3 drs.	1 to 6 tolas	2 to 6 tolas	...	Mudar root
Calotropis gigantea flowers ...	Aak ka phul ...	မရိုးပွင့် ...	Do.	Vesicant; cleanses foul ulcers— <i>Gilchrist</i>	...	2 to 6 tolas	...	...	Mudar flowers
Calomel ...	Ras kapur— <i>Steel</i> . Para ka khan— <i>Slymm</i>	ပြထားသီးချို ...	Alterative— <i>Steel</i> , <i>Slymm</i> . Aperient— <i>Steel</i> . Cathar- tic, sedative, diaphoretic, anthelmintic, diuretic in liver diseases	Caustic— <i>Steel</i> . Flicked in eye in opacity of cornea	½ to 1 dr.	½ to 3 tolas	...	½ to 1½ drs.	Care should be ex- ercised with this drug; commence with ½ dr.
Camphor ...	Kapoor, kafur — <i>Steel</i>	ပချတ် ...	Anti-spasmodic, narcotic— <i>Steel</i> . Stimulant, seda- tive in chronic cough— <i>Tuon</i>	...	5 drs. to 3 ozs.	2 to 4 tolas	...	2 to 6 drs.	
Camphor lnt. comp. ...	...	...	...	Counter-irritant in sprains, rheumatism, bronchitis, and swellings; stimulant	...	...	...	...	
Camphorated oil ...	...	...	...	Dressing for wounds, keeps off flies, anti-maggots, stimulant, antiseptic and for removal of maggots	...	...	...	...	
Cantharidis oint- ment ...	...	...	...	Vesicant, counter-irritant, rube-facient	...	...	...	...	Spanish flies
Capsicums ...	Mitch— <i>Steel</i>	ငရုတ်သီး ...	Stimulant— <i>Steel</i> , <i>Slymm</i> . Carminative— <i>Tuon</i>	Rube-facient, vesicant— <i>Tuon</i>	2 drs.	2 to 6 tolas	...	½ to 1½ drs.	Capsicum fastigla- tum; chillies
Carbo ligni ...	...	မီးသွေး ...	In dyspepsia and flatulency and diarrhea— <i>Tuon</i> . Antidote to aconite strychnia	Deodorizer, disinfectant, desiccant to unhealthy wounds and ulcers. In poultices	...	...	...	...	Charcoal
Cardamons ...	Ilachi— <i>Steel</i>	ပါလာ ...	Aromatic, stimulant— <i>Steel</i> . Carminative— <i>Slymm</i>	...	½ to 1 oz.	6 to 12 tolas	...	½ to 1 oz.	Elettaria cardamo- mum
Caraway seeds ...	Omam— <i>Steel</i> . Jera sulfaid — <i>Slymm</i>	ကလေးငွေ ...	Stimulant— <i>Steel</i> . Carmi- native— <i>Slymm</i> . Stom- achic, aromatic	...	½ to 1 oz.	6 to 12 tolas	...	½ to 1 oz.	Caram carui

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	USES.		Steel.	DOSES.			Remarks.
			Internal.	External.		Slymm.	Gilchrist.	—	
Carron oil	...	...	...	Application to scalds and burns; very useful	...	...	...	...	Cassia fistula, Cassia auriculata, Cassia senna
Cassia (bark)	Amaltas	ရကြီးခေါက်	Astringent— <i>Steel</i>	Detergent to sloughy and indolent ulcers, wounds, bruises, burns, etc.— <i>Steel</i>	...	...	...	...	...
Cassia leaves	Soona maki	မွေးထိုင်းချွက်	Purgative, tonic, laxative	Do.	1 to 6 lbs.	10 to 60 tolas	...	1 to 2 lbs.	...
Cassia pulp	Amaltas	ရကြီးအသီးဖျီ	Tonic, laxative, purgative	Do.	1 to 3 ozs.	2 to 8 tolas	2 to 6 tolas	1 to 3 ozs.	...
Castor oil	Erundi ka tel	အဝါအစိမ်း	Purgative	Emollient	2 pints	40 to 100 tolas	...	1½ pints	...
Castor-oil tree stalks	Erundi ka cup-lee— <i>Slymm</i>	ကြက်ဆူဆီ	Tonic, aperient— <i>Slymm</i>	Leaves made into poultice with barley meal are applied to inflammatory affections of the eye— <i>Khory</i>	...	1 to 3 seers	...	...	Ricinus communis
Castor seeds	Erundi binj	ကြက်ဆူဆီ	...	Poultice of crushed seeds good to promote suppuration in boils and reduce rheumatic swellings— <i>Khory</i>	...	...	...	...	...
Catechu	Kat, katha	ခါးခွေး	Astringent	Astringent, chloping, sores and ulcers	...	6 to 10 tolas, 1 to 1 seers, 1 to 20 tolas	5 drs. to 6 ozs.	6 to 8 drs.	Acacia catechu * Black catechu † White catechu
Chalk, prepared	Khary mitti	မြေမြေ	Astringent— <i>Steel</i> . Antacid, absorbent— <i>Slymm</i>	Desiccant— <i>Steel</i> . Burns and scalds	4 ozs.	...	...	2 to 4 ozs.	...
Chirretta	Charayata— <i>Steel</i>	ထေးခါးကြီး	Tonic — <i>Steel</i> . <i>Slymm</i> . Stomachic, promotes secretion of bile— <i>Steel</i> . Alterative, anti-periodic— <i>Yuum</i>	...	1 to 3 ozs.	2 to 8 tolas	...	1 to 2 ozs.	Ophelia chirrata

List of Drugs employed in the Treatment of Elephants—continued.

146

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Symm.	Gilchrist.	—	
Carron oil	...	...	...	Application to scalds and burns; very useful	...	...	...	...	
Cassia (bark)	Amaltas	ရကြီးခေါက်	Astringent— <i>Steel</i>	Detergent to sloughy and indolent ulcers, wounds, bruises, burns, etc.— <i>Steel</i>	...	...	...	...	Cassia fistula, Cassia auriculata, Cassia senna
Cassia leaves	Soona maki	မွေးရိုင်းရွက်	Purgative, tonic, laxative	Do.	1 to 6 lbs.	10 to 60 tolas	...	1 to 2 lbs.	
Cassia pulp	Amaltas	ရကြီးအသီး၏ အသား။	Tonic, laxative, purgative	Do.	1 to 3 ozs.	2 to 8 tolas	2 to 6 tolas	1 to 3 ozs.	
Castor oil	Erundi ka tel	ကြက်ဆူဆီ	Purgative	Emollient	2 pints	40 to 100 tolas	...	1½ pints	
Castor-oil tree stalks	Erundi ka cup- -lice— <i>Symm</i>	ကြက်ဆူအတ္ထုနီ	Tonic, aperient— <i>Symm</i>	Leaves made into poultice with barley meal are applied to inflammatory affections of the eye— <i>Khory</i>	...	1 to 3 seers	...	...	Ricinus communis
Castor seeds	Erundi binj	ကြက်ဆူစေ့	...	Poultice of crushed seeds good to promote suppuration in boils and reduce rheumatic swellings— <i>Khory</i>	...	...	...	...	
Catechu	Kat, katha	ရှားဝေ	Astringent	Astringent, chobing, sores and ulcers	...	6 to 10 tolas,* 1 to 1 seer †	5 drs. to 6 ozs.	6 to 8 drs.	Acacia catechu * Black catechu † White catechu
Chalk, prepared	Khary mitti	မြေမြိ	Astringent— <i>Steel</i> . Antacid, absorbent— <i>Symm</i>	Desiccant— <i>Steel</i> . Burns and scalds	4 ozs.	10 to 20 tolas	...	2 to 4 ozs.	
Chirretta	Charayata— <i>Steel</i>	ဆေးခါးကြီး	Tonic — <i>Steel</i> , <i>Symm</i> . Stomachic, promotes secretion of bile— <i>Steel</i> . Alterative, anti-periodic— <i>Tuson</i>	...	1 to 3 ozs.	2 to 8 tolas	...	1 to 2 ozs.	Ophelia chirata

A TREATISE ON ELEPHANTS.

Chloral hydrate	...	...	Stimulant, sedative, anodyne, anti-spasmodic, narcotic— <i>Tuson</i>	...	...	...	...	2 to 6 drs.	May be added to enemata
Chloride of lime	...	...	Used in flatulency	Deodorizer, stimulant, disinfectant, and in skin diseases	½ oz.	...	...	...	
Cinchona bark	...	...	Tonic, anti-periodic, astringent, in fever, rheumatism	Astringent, antiseptic, to fetid ulcers— <i>Tuson</i>	...	...	...	3 to 4 drs.	Cinchona calisaya
Cinnamon	Daichini taj— <i>Khory</i>	သစ်ကြံ့ကြီး	Carminative, stimulant— <i>Symm</i> . Stomachic, aromatic— <i>Finlay Dun</i>	...	...	2 to 6 tolas	...	½ oz.	Bark of cinnamomum zeylanicum— <i>Khory</i>
Cloves	Lavung	ဆေးထွင်းပွင့်	Carminative— <i>Symm</i> . Stimulant, aromatic, stomachic, in flatulency— <i>Khory</i>	...	...	2 to 4 tolas	...	½ oz.	Caryophyllus aromatics
Coal-tar	...	...	...	Excitant, antiseptic, in diseases of feet— <i>Finlay Dun</i>	...	...	...	...	
Colocynth	Indrayen	ကြံ့အသီး ကျောက်ပရိသီး	Hydragogue cathartic; especially valuable in liver congestion— <i>Steel</i>	...	...	2 to 4 tolas	6 to 18 ozs.	4 to 6 drs.	Bitter apple. Citrullus colocynthis (fruit); used with care and combined with hennbane Cocos nucifera (fruit)
Cocoanut kernel	Khopra— <i>Khory</i>	အုန်းသီး	Astringent— <i>Steel</i> . Nourishing, cooling, refrigerating— <i>Khory</i>	...	...	...	...	...	
Cocoanut oil	Khopra ka tel; narial ka tel	အုန်းဆီ	Demulcent, emollient, nutritive— <i>Steel</i>	Emollient— <i>Steel</i> . Vehicle, wound dressing; promotes growth of hair	Ad lib.	...	...	...	
Candy's fluid	...	...	...	Deodorizer, antiseptic	...	...	...	...	
Coriander fruit	Dhanya	နံနံစေ့စပ်	Aromatic, stimulant, carminative— <i>Steel</i> , <i>Symm</i>	...	½ to 1 oz.	½ to 1 seer	...	½ to 2 ozs.	Contains four grains of permanganate of potash in each ounce. Fruit of coriandrum sativum
Corrosive sublimate	Shavir— <i>Steel</i> . Ras ka poor— <i>Khory</i>	...	...	Corrosive— <i>Steel</i> . Caustic, stimulant, anti-parasitic— <i>Tuson</i>	...	...	...	...	
Creosote	...	...	...	Caustic, antiseptic, same as carbolic acid— <i>Tuson</i>	...	...	...	...	

LIST OF DRUGS.

147

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	USES.		DOSES.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.		
Creosote ointment	...	...	...	Dressing for wounds, indolent and sloughing ulcers; keeps off flies	6 drs. to 1½ ozs.	2 to 4 tolas	6 drs. to 1½ ozs.	2 to 4½ drs.	Seeds of croton tiglium
Croton seeds	Jepal— <i>Steel</i> . Jamal gotah	ရတနာတံတို	Cathartic— <i>Steel</i> , <i>Slymm</i> ...	...	...	...	...	30 to 40 mms.	...
Croton oil	Jamal gotah ka tel	ရခါ	Do. ...	Vesicant, counter-irritant	...	...	...	...	...
Cubebs	Kabab chini ...	ပိတ်ချင်း	Aromatic stimulant, valuable in cases of catarrh, in small doses— <i>Steel</i> . Diuretic— <i>Slymm</i> ...	...	...	2 to 8 tolas	...	...	Fruit of cubeba officinalis
Cumin seeds	Kala jeera ...	နီယာအနက်	Carminative	...	...	6 to 12 tolas	...	4 to 8 drs.	Fruit of cuminum cuminum
Custard-apple leaves	Secta phul ka putta	တြိတရ	Small doses, tonic, cathartic— <i>Steel</i>	Anti-maggots when bruised and applied to wounds— <i>Steel</i>	...	100 to 250 leaves	...	100 to 500 leaves	Anona reticulata
Cupri sulphas	Nila tuta— <i>Steel</i> . Morthutha— <i>Slymm</i>	ဒုတ္တ	Astringent, tonic— <i>Steel</i> , <i>Slymm</i>	Mild caustic, detergent to unhealthy and sloughing wounds and ulcers	½ dr.	½ to ½ tola	...	1 to 2 drs.	Blue-stone
Cupri lotion	...	ဒုတ္တရည်	...	Astringent, stimulant, mild caustic, collyrium, according to strength	...	...	...	...	Blue-stone lotion
Dhatūra leaves	Dhatūra ka putta.	ပရိုင်းရွက်	Anti-spasmodic, anodyne, narcotic; in musth	Anodyne, most valuable in rheumatic pains. As poultice in sloughing and irritable wounds— <i>Steel</i>	½ to 2 and 4 to 6 drs.	...	...	½ oz.	Leaves of dhatūra alba and dhatūra festuosa
Dhatūra seeds	Dhatūray ...	ပရိုင်းစေ့	Narcotic, in musth— <i>Steel</i> . Anodyne, anti-spasmodic, excitant— <i>Steel</i> , <i>Slymm</i>	...	4 to 6 drs.	½ to 2 tolas	...	2 to 4 drs.	...
Dikamall	Dikamalee ...	...	Anti-spasmodic	Anti-fly dressing. Stimulant applied to wounds	½ to 1 oz.	...	2 to 8 tolas	...	Resinous exudation from various species of gar-denia

List of Drugs employed in the Treatment of Elephants—continued.

148

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Slymm.	Glchrist.	—	
Cressote ointment	...	...	...	Dressing for wounds, indolent and sloughing ulcers; keeps off flies	...	...	...	...	
Croton seeds	Jepal— <i>Steel</i> . Jamal gotah	ငုဇုဝါဒိဇု	Cathartic— <i>Steel</i> , <i>Slymm</i>	...	6 drs. to 1½ ozs.	2 to 4 tolas	6 drs. to 1½ ozs.	2 to 4 drs.	Seeds of croton tiglium
Croton oil	Jamal gotah ka tel	ငုဇီ	Do.	Vesicant, counter-irritant	...	...	...	30 to 40 mms.	
Cubebe	Kabab chini	ပိတ်ချင်း	Aromatic, stimulant, valuable in cases of catarrh, in small doses— <i>Steel</i> . Diuretic— <i>Slymm</i>	...	½ to 1 oz.	2 to 8 tolas	...	...	Fruit of cubeba officinalis
Cummin seeds	Kala jeera	ဇီယာအနက်	Carminative	...	...	6 to 12 tolas	...	4 to 8 drs.	Fruit of cuminum cuminum
Custard-apple leaves	Seeta phul ka putta	ထွဏ္ဍာရွက်	Small doses, tonic, cathartic— <i>Steel</i>	Anti-maggots when bruised and applied to wounds— <i>Steel</i>	...	100 to 250 leaves	...	100 to 300 leaves	Anona reticulata
Cupri sulphas	Nila tuta— <i>Steel</i> . Morthutha— <i>Slymm</i> .	မုတ္တ	Astringent, tonic— <i>Steel</i> , <i>Slymm</i>	Mild caustic, detergent to unhealthy and sloughing wounds and ulcers	½ dr.	½ to ½ tola	...	1 to 2 drs.	Blue-stone
Cupri lotion	...	မုတ္တရည်	...	Astringent, stimulant, mild caustic, collyrium, according to strength	...	...	...	...	Blue-stone lotion
Dhatara leaves	Dhatara ka	ပဒိုင်းရွက်	Anti-spasmodic, anodyne, narcotic; in inusu	Anodyne, most valuable in rheumatic pains. As poultice in sloughing and irritable wound— <i>Steel</i>	½ to 2 and 4 to 6 drs.	...	...	½ oz.	Leaves of dhatara aiba and dhatara festuosa
Dhatara seeds	Dhataray	ပဒိုင်းဇု	Narcotic, in mnsth— <i>Steel</i> . Anodyne, anti-spasmodic, excitant— <i>Steel</i> , <i>Slymm</i>	...	4 to 6 drs.	½ to 2 tolas	...	2 to 4 drs.	
Dikamall	Dikamalee	...	Anti-spasmodic	Anti-fly dressing. Stimulant applied to wounds	½ to 1 oz.	...	2 to 8 tolas	...	Resinous exudation from various species of gardenia

A TREATISE ON ELEPHANTS.

Dikamall ointment	...	...	...	Wound dressing to keep away flies	...	...	...	...	
Dill seeds	Matthee suva— <i>Slymm</i> . Soyah— <i>Khery</i>	...	Carminative— <i>Slymm</i> . Tonic, diuretic, resolvent— <i>Khery</i>	...	...	½ to 3 seers	...	...	Fruits of anethum graneolens— <i>Khery</i>
Donovan's solution	...	...	Alterative, tonic, anti-periodic	...	...	...	...	1 to 1½ ozs.	
Epsom salts	Bilayeti muck	...	Cathartic— <i>Slymm</i> . Diuretic, febrifuge— <i>Tyson</i>	...	...	8 to 16 ozs.	...	10 ozs. to 1 lb.	Magnesia sulphas
Eucalyptus oil	...	...	...	Antiseptic, deodorizer, stimulant, disinfectant	...	...	...	...	Eucalyptus globulus
Eucalyptus ointment	...	...	...	Anti-fly dressing; dressing for wounds and ulcers	...	...	...	...	
Extract of nux vomica	...	...	Nervous stimulant and tonic in paralysis, paraplegia, etc.	...	...	...	...	10 grs.	Seeds of strychnos nux vomica.
Fennel	Sonffe	...	Carminative, stomachic, aromatic— <i>Tyson</i>	...	...	...	...	1 to 4 drs.	Fruits of foniculum vulgare
Fenugreek	Matthi	...	Carminative— <i>Slymm</i> . Aromatic, diuretic, demulcent, nutritive, emmenagogue	...	...	½ to 2 seers	...	½ to 3 ozs.	Seeds of trigonella fœnugræcum
Ferri carbonas saccharata	...	...	Same as ferri sulphas	...	...	...	...	2 drs.	
Ferri iodum	...	...	Tonic, alterative, astringent, hæmantic— <i>Tyson</i>	...	...	...	...	2 drs.	
Ferri sulphas	Hira kasi	ပါထရတ္တ	Tonic— <i>Steel</i> , <i>Slymm</i> . Astringent, hæmantic— <i>Tyson</i> .	Astringent, styptic	3 to 6 drs.	1 to 4 tolas	...	2½ drs.	
Ferri perchloride tincture (dilute)	...	...	Tonic, astringent— <i>Tyson</i>	Styptic, astringent, caustic— <i>Tyson</i> . (Strong tincture.)	...	...	...	1 oz.	
Friar's balsam	...	...	...	Antiseptic, disinfectant, deodorizer, wound dressing	...	...	...	...	
Galls, oak	Maza phul— <i>Steel</i> . Mah phul— <i>Slymm</i>	ပဉ္စကာနီသီး	Astringent— <i>Steel</i> , <i>Slymm</i> . Styptic— <i>Tyson</i>	Astringent— <i>Steel</i> . Anti-septic— <i>Slymm</i>	...	...	1 dr. to 1 oz.	2 to 4 drs.	Exscrecences formed on the young branches of the oak, Quercus infectoria— <i>Tyson</i>

LIST OF DRUGS.

149

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	USES.		DOSES.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	—	
Ganja	...	...	Narcotic, excitant— <i>Slymm</i>	...	...	$\frac{1}{2}$ to 2 tolas	$\frac{1}{2}$ to 1 oz.	2 to 6 drs.	Tops of cannabissativa, var. ludica
Garlic	...	...	Carminative — <i>Slymm</i> . Stimulant, diuretic, digestive for elephants when first brought on to green food or which have been exposed to a chill— <i>Steel</i>	Rubefacient. Blister (made into a paste with two-thirds its weight of flour and left on for 15 minutes, acts as a powerful blister)— <i>Steel</i>	$\frac{1}{2}$ to 1 oz.	2 to 4 tolas	1 to 5 seers	1 oz.	
Gentian	...	...	Bitter tonic— <i>Steel</i> , <i>Slymm</i> . Stomachic	...	2 ozs.	2 to 8 tolas	...	$\frac{1}{2}$ to 2 ozs.	Gentian lutea
Ghee	...	...	Vehicle, demulcent, laxative, nutrient	Vehicle— <i>Steel</i> . Emollient; protective in skin affections against sun's rays— <i>Steel</i>	lbs. 2, $\frac{1}{2}$ to 3 seers	...	...	1 to 2 lbs.	
Ginger, dry	...	...	Aromatic, stimulant, carminative, tonic, stomachic— <i>Steel</i>	...	1 oz.	...	...	6 to 8 drs.	Scraped and dried rhizome of zingiber officinalis
Ginger, green	...	...	Carminative, stomachic— <i>Slymm</i>	...	...	6 to 12 tolas	...	$\frac{1}{2}$ lb.	Rhizome of zingiber officinalis
Glycerine	...	...	...	Emollient— <i>Steel</i> . To exfoliate, cracks, and blistersed surfaces— <i>Turron</i> .	...	...	...	...	
Hellebore (black)	...	...	Narcotic, excitant— <i>Slymm</i>	...	...	$\frac{1}{2}$ to 1 tola	...	...	Helleborus niger
Hemp, Indian	...	...	Narcotic, anodyne, antispasmodic, hypnotic; causes relaxation of muscular spasms, hence useful in cases of calculi which have become impacted— <i>Steel</i> . Stimulant tonic— <i>Slymm</i> . In tetanus, rheumatism, and rabies— <i>Steel</i>	...	5 to 10 drs.	2 to 4 tolas of biang; $\frac{1}{2}$ to 2 tolas of ganja	4 to 8 drs. of ganja	2 to 6 drs. of ganja; 5 to 10 drs. of biang	Cannabissativa, var. Indica

LIST OF DRUGS.

151

Hydrargyri Iodidum rubrum ointment and ointment	...	...	...	...	Blister, counter-irritant, caustic, stimulant; ac- cording to strength	...	...	...	...	Red mercury blister
Honey	Shah— <i>Slymm</i> , Shahad or mudh— <i>Steel</i>	...	...	...	Laxative, emollient, demul- cent— <i>Slymm</i>	...	...	...	...	<i>Ad lib.</i>
Huldee	Huldee	...	...	...	<i>See</i> Turmeric	...	...	...	...	...
Hyoscyamus	Khorasani aj- wan— <i>Steel</i>	...	...	...	Narcotic, soporific, ano- dyne, anti-spasmodic— <i>Steel</i> ; Sedative— <i>Slymm</i> , <i>Dunac</i> tonic— <i>Philary</i>	Anodyne— <i>Steel</i> . Leaves as poultice	1 to 2— <i>Steel</i> 2 to 4— <i>Steel</i>	1 to 3 ozs. (seeds)	2 to 4 drs. (leaves)	Leaves and seeds (especially) of hyoscyamus niger
Ink nuts	Kakar ulday	...	...	...	Tonic, astringent	Astringent. To tender feet and sore eyes— <i>Steel</i>	4 drs.; 2 to 8 tolas	2 to 8 tolas	...	Galls of rhus suc- danca
Iodine	...	...	...	...	Tonic, alterative, resolvent, deobstruent— <i>Tyson</i>	...	...	...	...	...
Iodine liniment; iodine ointment	...	...	...	...	...	Stimulant, resolvent (to bursæ) and enlarged glands— <i>Tyson</i>	...	...	...	...
Iodine tincture	...	...	...	...	...	Caustic, stimulant, deob- struent, resolvent, diluted in sinuses and abscesses	...	...	...	...
Iodoform	...	...	...	...	...	Antiseptic, wound dressing, anti-fly dressing	...	...	...	...
Iodoform ointment	...	...	...	...	...	Do.	...	...	...	Mollasses
Jaggery (treacle)	Goor	...	...	ထန်းချွတ်	Nutritive, demulcent, laxative, vehicle— <i>Steel</i>	...	<i>Ad lib.</i>	...	...	Sesamum Indicum
Jimili leaves	...	...	...	နှိမ်းရွက်	...	Demulcent, emollient— <i>Steel</i>	...	...	...	...
Jimili oil	Mitha tel, til ka tel, barik tel— <i>Steel</i>	...	...	နှိမ်းဆီ	Substitute for olive oil; vehicle, laxative, demul- cent, and emollient— <i>Steel</i>	Emollient, demulcent, vehicle	1 to 2 pints	...	1 to 2 pints	Fixed oil obtained by expression from the seeds of above
Jimili seeds	Tib	...	...	နှိမ်းပဲ	Emmenagogue — <i>Steel</i> , Laxative	...	...	...	...	...
Kerosene oil	Muttee ka tel— <i>Slymm</i>	...	...	ရေနံဆီ	...	Excitant— <i>Slymm</i>	...	...	...	...
Kootkie	Kutki— <i>Steel</i>	...	...	ဂါးဝေ	A valuable tonic— <i>Steel</i> . Febrifuge, anti-periodic, anticholitic— <i>Steel</i>	...	4 to 8 drs.; 2 to 6 tolas	...	...	Stem with the root of Picrorhiza kurroa

List of Drugs employed in the Treatment of Elephants—continued.

150

A TREATISE ON ELEPHANTS.

Drugs.	Hindustani.	Burmese.	USES.		DOSES.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	—	
Ganja	Ganja	ဆေးခြောက်ပွင့်	Narcotic, excitant— <i>Slymm</i>	...	...	$\frac{1}{2}$ to 2 tolas	$\frac{1}{2}$ to 1 oz.	2 to 6 drs.	Tops of cannabis sativa, var. Indica
Garlic	Lassan	ခြောက်ထွန်မြို့	Carminative — <i>Slymm</i> . Stimulant, diuretic, digestive for elephants when first brought on to green food or which have been exposed to a chill— <i>Steel</i>	Rubefacient. Blister (made into a paste with two-thirds its weight of flour and left on for 15 minutes, acts as a powerful blister)— <i>Steel</i>	$\frac{1}{2}$ to 1 oz.	2 to 4 tolas	1 to 3 seers	1 oz.	
Gentian	Pakhan bed	ဆေးပုလဲ	Bitter tonic— <i>Steel</i> , <i>Slymm</i> . Stomachic	...	2 ozs.	2 to 8 tolas	...	$\frac{1}{2}$ to 2 ozs.	Gentian lutea
Ghee	Ghee	ထောပတ်	Vehcle, demulcent, laxative, nutrient	Vehicle— <i>Steel</i> . Emollient; protective in skin affections against sun's rays— <i>Steel</i>	lbs. 2, $\frac{1}{2}$ to 3 seers	...	...	1 to 2 lbs.	
Ginger, dry	Sohnt	ရှမ်းချောက်	Aromatic, stimulant, carminative, tonic, stomachic— <i>Steel</i>	...	1 oz.	...	...	6 to 8 drs.	Scraped and dried rhizome of zingiber officinalis
Ginger, green	Uddaruck	ရှမ်းပိမ်း	Carminative, stomachic— <i>Slymm</i>	...	...	6 to 12 tolas	...	$\frac{1}{2}$ lb.	Rhizome of zingiber officinalis
Glycerine	...	...	...	Emollient— <i>Steel</i> . To excoriated, cracked heels, burns, scalds, and blistered surfaces— <i>Fusion</i>	...	...	...	...	
Hellebore (black)	Kala bitchi wa— <i>Slymm</i>	ရှိမ်းဂေား	Narcotic, excitant— <i>Slymm</i>	...	...	$\frac{1}{2}$ to 1 tola	...	...	Helleborus niger
Hemp, Indian	Bhang or subzi (leaves of plant) (Tops ganja)	ဆေး ခြောက် ထင်း	Narcotic, anodyne, antispasmodic, hypnotic; causes relaxation of muscular spasms, hence useful in cases of calcoli which have become impacted— <i>Steel</i> . Stimulant, tonic— <i>Slymm</i> . In tetanus, rheumatism, and rabies— <i>Steel</i>	...	5 to 10 drs.	2 to 4 tolas of bhang; $\frac{1}{2}$ to 2 tolas of ganja	4 to 8 drs. of ganja	2 to 6 drs. of ganja; 5 to 10 drs. of bhang	Cannabis sativa, var. Indica

Hydrargyri Iodidum rubrum ointment (red ointment)	...	...	...	Blister, counter-irritant, caustic, stimulant; according to strength	...	...	...	...	Red mercury blister
Floury	Shath— <i>Slymm</i> . Shabad or mudh— <i>Steel</i>	ဗျာရည်	Laxative, emollient, demulcent— <i>Slymm</i>	...	...	...	...	Ad lib.	
Huldee	Huldee	နီနီထောင်	See Turmeric	...	...	...	...	...	
Hyoscyamus	Khorasani gyan— <i>Steel</i>	ဟုန်းသီး	Narcotic, soporific, anodyne, antispasmodic— <i>Steel</i> . Sedative— <i>Slymm</i> . Cardiac tonic— <i>Finlay Dun</i>	Anodyne— <i>Steel</i> . Leaves as poultice	2 to 3— <i>Steel</i> 2 to 4— <i>Steel</i>	1 to 3 tolas	1 to 3 ozs. (seeds)	2 to 4 drs. (leaves)	Leaves and seeds (especially) of hyoscyamus niger
Ink nuts	Kakar ulday	ချေးသီး	Tonic, astringent	Astringent. To tender feet and sore eyes— <i>Steel</i>	4 drs.; 2 to 8 tolas	2 to 6 tolas	2 to 8 tolas	...	Galls of rhus succedanea
Iodine	...	...	Tonic, alterative, resolvent, deobstruent— <i>Fusion</i>	...	...	...	...	$\frac{1}{2}$ dr.	
Iodine liniment; iodine ointment	...	...	...	Stimulant, resolvent (to purge) and enlarged glands— <i>Fusion</i>	...	...	...	...	
Iodine tincture	...	...	...	Caustic, stimulant, deobstruent; injected diluted in sinuses, and abscesses	...	...	...	...	
Iodoform	...	...	...	Antiseptic, wound dressing, anti-fly dressing	...	...	...	...	
Iodoform ointment	...	...	...	Do.	...	...	...	...	
Jaggery (treacle)	Goor	ထန်းချက်	Nutritive, demulcent, laxative, vehicle— <i>Steel</i>	...	Ad lib.	...	...	...	Mollasses
Jinjili leaves	...	နီနီချက်	...	Demulcent, emollient— <i>Steel</i>	...	...	...	...	Sesamum Indicum
Jinjili oil	Mitha tel, til ka tel, bark tel— <i>Steel</i>	နီနီဆီ	Substitute for olive oil; vehicle, laxative, demulcent, and emollient— <i>Steel</i>	Emollient, demulcent, vehicle	1 to 2 pints	$\frac{1}{2}$ to 3 seers	$\frac{1}{2}$ to 4 seers	1 to 2 pints	Fixed oil obtained by expression from the seeds of above
Jinjili seeds	Tib	နီနီငွေ	Emmenagogue — <i>Steel</i> . Laxative	...	...	...	...	...	
Kerosene oil	Mutte ka tel— <i>Slymm</i>	ရေနံဆီ	...	Excitant— <i>Slymm</i>	...	...	...	...	
Kootkie	Kutki— <i>Steel</i>	ရှိမ်းဝက်	A valuable tonic— <i>Steel</i> . Febrifuge, anti-periodic, anthelmintic— <i>Steel</i>	...	4 to 8 drs.; 2 to 6 tolas	...	...	$\frac{1}{2}$ to 1 oz.	Stem with the root of Ficus religiosa

LIST OF DRUGS.

151

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gitchrist.	—	
Lead acetate	...	သံသကြား	Sedative, astringent, in diabetes— <i>Tuon</i>	...	...	...	...	$\frac{1}{2}$ to 1 dr.	
Lead lotion	...	သံသကြားရည်	...	Astringent, sedative, cooling to wounds, etc.	...	...	...	...	
Lead subacetate liquor	...	...	...	Astringent, sedative, cooling to wounds— <i>Tuon</i>	...	...	...	...	Goulard's extract
Lemon juice	...	သံပုရာရည်	Refrigerant— <i>Slymm</i>	...	...	4 to 6 tolas	...	...	
Lime	...	ထုံး	...	Caustic, desiccant	...	...	...	8 to 10 ozs.	
Lime water	...	ထုံးရည်	Antacid, in flatulency	...	...	...	...	...	
Linseed meal	...	ပိတ်သံမေ့	Demulcent— <i>Steel</i> . Emollient, nutrient— <i>Slymm</i> . Laxative— <i>Tuon</i>	Astringent — <i>Steel</i> . Poultice	<i>Ad lib.</i>	2 to 12 tolas	...	...	Seeds of <i>linum usitatissimum</i>
Linseed oil	...	ပိတ်သံဆီ	Nutritive, laxative, emollient, vehicle— <i>Tuon</i>	Emollient, vehicle— <i>Tuon</i>	...	...	...	1 to 1½ pints	
Liquor ammonia (dilute)	...	...	...	Counter-irritant	...	...	...	4 ozs.	
Liquor ammonia acetate	...	...	Mild stimulant, diaphoretic, diuretic, febrifuge— <i>Tuon</i>	Discutient	...	...	...	$\frac{1}{2}$ to 1 oz.	Strength 4 grains of arsenic in each ounce
Liquor arsenicalis	...	...	...	...	...	...	...	4 to 8 drs.	Root of glycyrrhiza glabra. Steel says roots of <i>abus pccatorius</i> is an efficient substitute
Liquorice root (country)	Mitta lukhre— <i>Slymm</i> . Jathi madh mulati — <i>Khory</i>	နွတ်ချိုနှင့်	Tonic, nutrient — <i>Steel</i> , <i>Slymm</i> . Demulcent. laxative, expectorant, diuretic— <i>Khory</i>	Suppurative, detergent— <i>Steel</i>	...	$\frac{1}{2}$ to 2 seers	...	...	

List of Drugs employed in the Treatment of Elephants—continued.

152

A TREATISE ON ELEPHANTS.

Drugs.	Hindustani.	Burmese.	Uses.		DOSES.				Remarks.
			Internal.	External.	Steel.	Symm.	Gilchrist.	—	
Lead acetate ...	...	ဝဲသကြား	Sedative, astringent, in diabetes— <i>Tuson</i>	...	...	...	...	½ to 1 dr.	Goulard's extract
Lead lotion ...	...	ဝဲသကြားရည်	...	Astringent, sedative, cooling to wounds, etc.	...	...	...	...	
Lead subacetate liquor ...	...	...	...	Astringent, sedative, cooling to wounds— <i>Tuson</i>	...	...	...	...	
Lemon juice ...	Nimboo ka rus	သံ ပု ရာ ရည် ရှောက်ရည်	Refrigerant— <i>Symm</i>	...	...	4 to 6 tolas	...	...	
Lime ...	Chuna	ထုံး	...	Caustic, desiccant	...	...	...	...	Seeds of <i>Hum usitatissimum</i>
Lime water ...	...	ထုံးရည်	Antacid, in flatulency	...	...	...	...	8 to 10 ozs.	
Linseed meal ...	Alsi-tisi	ပိတ်သံစေ့	Demulcent— <i>Steel</i> . Emollient, nutritive— <i>Symm</i> . Laxative— <i>Tuson</i>	Astringent— <i>Steel</i> . As poultice	Ad lib.	3 to 13 tolas	...	...	
Linseed oil ...	Alsi ka tel	ပိတ်သံဆီ	Nutritive, laxative, emollient, vehicle— <i>Tuson</i>	Emollient, vehicle— <i>Tuson</i>	...	...	...	1 to 1½ pints	
Liquor ammonia (dilute) ...	...	...	...	Counter-irritant	...	...	...	...	Strength 4 grains of arsenic in each ounce Root of glycyrrhiza glabra. Steel says roots of <i>abus precatorius</i> is an efficient substitute
Liquor ammonia acetate ...	...	...	Mild stimulant, diaphoretic, diuretic, icterifuge— <i>Tuson</i>	Discutient	...	...	...	4 ozs.	
Liquor arsenicalis ...	...	...	...	...	...	...	...	½ to 1 oz.	
Liquorice root (country) ...	Mitta lukhre— <i>Symm</i> . Jathi maath mulati— <i>Khory</i>	နွယ်ချိုမြိန်	Tonic, nutrient— <i>Steel</i> , <i>Symm</i> . Demulcent, laxative, expectorant, diuretic— <i>Khory</i>	Suppurative, detergent— <i>Steel</i>	...	4 to 3 scrubs	...	4 to 8 drs.	

Mace ...	Janantri ...	စာမိဉ္ဇိ ထိပ္ပဉ်	Carmine— <i>Symm</i> . Stimulant, digestive, tonic, astringent— <i>Khory</i>	...	...	½ to 4 tolas	...	4 to 6 drs.	Arilus of the seeds of myristica officinalis
Mango tree bark ...	Aam ka zad ka chai	သရက်ခေါက်	Tonic, astringent— <i>Steel</i>	Mild astringent	...	...	...	...	Bark of <i>Mangifera indica</i>
Mango seeds ...	Aam ka bit-chee	သရက်စေ့	Kernel of the seed said to be good for expelling worms	...	...	...	...	...	...
Margosa bark ...	Neem ka chhal	သင်္ဃော ထမာ ခေါက်	Tonic, astringent, antiperiodic— <i>Steel</i> . Relieves thirst, vomiting and nausea in fever— <i>Khory</i>	In skin diseases— <i>Khory</i>	4 to 8 drs.	...	...	1 oz.	Bark of <i>Azadirachta indica</i>
Margosa fruit ...	...	သင်္ဃော ထမာ ဝေဉ်	Purgative, anthelmintic, emollient in urinary diseases— <i>Khory</i>	...	...	...	...	...	...
Margosa fruit oil ...	Neem ka tel	သင်္ဃော ထမာ ဆီ	Anti-spasmodic, anthelmintic— <i>Steel</i> . Stimulant— <i>Khory</i> , <i>Steel</i>	In sprains and rheumatism, parasiticide, anti-fly dressing; also keeps off maggots; used for sore shanks, bruised legs, etc.— <i>Steel</i>	...	...	...	...	...
Margosa leaves ...	Neem ka putta	သင်္ဃော ထမာ ရွက်	Vermifuge— <i>Steel</i> . In jaundice and skin diseases, such as boils, prurigo, etc.— <i>Khory</i>	Stimulant to ulcers and in chronic skin diseases; used as poultice— <i>Steel</i> . Discutient; useful in dispersing indolent glandular swellings, made into a pulp; useful application to pustular eruptions, open sores and bruised joints— <i>Khory</i>	...	...	...	...	<i>Azadirachta indica</i>
Margosa tree ...	Neem ka zad	သင်္ဃော ထမာ ခါး	Deodorizer; febrifuge; its vicinity ensuring freedom from specific febrile disorders	...	...	...	...	...	...
Margosa tree toddy ...	Nim ka nira	...	Stomachic	...	...	...	...	...	...
Milk ...	Dudh	နို့	Emollient, nutritive, demulcent	...	Ad lib.	...	...	...	...
Milk, sour ...	...	နို့ရည်	...	...	...	...	...	5 to 10 lbs.	...

LIST OF DRUGS.

153

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	Uses.		Doses.			Remarks.
			Internal.	External.	Steel.	Symm.	Gilchrist.	
Moringa bark and roots	Munge— <i>Steel.</i> Sungum— <i>Khory</i>	မုန့်ဝ ဝုန့် ခေါက်ခင်း ဒေဋ္ဌိဝါ	Stimulant, diuretic, particularly indicated dropsy with debility— <i>Steel.</i> In cough— <i>Khory</i>	Application for contusions. Promotes suppuration. Stimulant to sloughing wounds— <i>Steel.</i> As poultice acts as rubefacient to reduce swellings, relieve rheumatic pains, etc.— <i>Khory</i>	...	...	1 to 4 lbs.	Moringa pterygo-spermea
Moringa flowers	Sengum ka phul	ခန့်ဝထွန်းပွင့်	Tonic, diuretic; increases flow of bile— <i>Khory</i>	...	...	...	...	...
Moringa leaves	Shegata pan— <i>Khory</i>	ခန့်ဝထွန်းရွက်	...	As poultice; useful in reducing glandular swellings. It always produces a blister— <i>Khory.</i> Rubefacient, counter-irritant	...	2 to 6 lbs.	...	Seeds of singpis alba and nigra
Mustard	Rai	မုံညင်းဇေ	Digestive, emetic in large doses— <i>Symm.</i> Stimulant, anti-spasmodic	Stimulant— <i>Steel.</i> Rubefacient, counter-irritant	...	...	...	...
Mustard oil	...	မုံညင်းဆီ	Mild aperient— <i>Khory</i>	Stimulant, anti-fly dressing, removes scurf and lice— <i>Khory</i>	2 drs. to 1 oz.	1 to 4 tolas	...	Gum resinous exudation from the stem of Balsamodendron myrrha— <i>Tuon</i>
Myrrh	Bol — <i>Steel.</i> Heerabole	မရန်းဇေ	Stimulant and tonic— <i>Steel.</i> Expectorant— <i>Symm.</i> In chronic cough— <i>Tuon.</i> Astringent and detergent— <i>Khory</i>	Traumatic— <i>Steel.</i> Exclatant, deodorizer— <i>Tuon</i>	...	...	...	Seeds of myristica officinalis
Nutmeg	Jaephul	စာဒိဂ္ဂါယံဝီး	Carminative— <i>Symm.</i> Stimulant, digestive tonic, astringent— <i>Khory.</i> Stimulant— <i>Steel.</i> Stimulant— <i>Symm.</i> Astringent— <i>Khory.</i> In chronic rheumatism, paralysis, chronic diarrhoea and dysentery. Good vermifuge— <i>Khory</i>	...	...	4 to 6 tolas	...	Seeds of stychnos nux vomita
Nux vomica	Kuchla— <i>Symm.</i> Kuchila— <i>Khory</i>	ခေါင်း	Stimulant, In diarrhoea— <i>Khory.</i> Anthrax.	Stimulant, rubefacient— <i>Khory</i>	½ to 2 drs.	½ to 2 tolas	½ to 2 drs.	Oil from cinna-momum zeylanicum
Oil, cinnamon	Darchini ka tel, taj ka tel	သစ်ကြီးဆီ	Laxative, nutritive, emollient, vehicle— <i>Tuon</i>	Emollient, vehicle— <i>Tuon</i>	...	...	...	From Olea Europæa
Olive oil	...	ထဲထွင်းဆီ	...	...	...	...	...	...

[illegible]

List of Drugs employed in the Treatment of Elephants—continued.

154

A TREATISE ON ELEPHANTS.

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Symm.	Gilchrist.	—	
Moringa bark and roots	Munge— <i>Steel</i> . Sengna— <i>Khory</i>	ခန့် သ ထွန် ခေါ် ဝံ ရင်း အခြစ်။	Stimulant, diuretic, particularly indicated in dropsy with debility— <i>Steel</i> . In cough— <i>Khory</i>	Application for contusions. Promotes absorption. Stimulant to sloughing wounds— <i>Steel</i> . As poultice acts as rubefacient to reduce swellings, relieve rheumatic pains, etc.— <i>Khory</i>			1 to 4 lbs.	...	Moringa pterygo-sperma
Moringa flowers ...	Sengna ka phul	ခန့်သထွန်ပွင့်	Tonic, diuretic; increases flow of bile— <i>Khory</i>						
Moringa leaves ...	Shagata pan— <i>Khory</i>	ခန့်သထွန်ရွက်	...	As poultice; useful in reducing glandular swellings. It always produces a blister— <i>Khory</i>					
Mustard ...	Rai ...	မုံညင်းရေ	Digestive, emetic in large doses— <i>Symm</i> . Stimulant, anti-spasmodic	Stimulant— <i>Steel</i> . Rubefacient, counter-irritant		2 to 6 lbs.		1 to 4 drs.	Seeds of sinapis alba and nigra
Mustard oil	...	မုံညင်းဆီ	Mild aperient— <i>Khory</i>	Stimulant, anti-dysentery, removes scurf and lice— <i>Khory</i>					
Myrrh	Bol— <i>Steel</i> . Heerabole	မရန်းဝေး	Stimulant and tonic— <i>Steel</i> . Expectorant— <i>Symm</i> . In chronic cough— <i>Tuon</i> . Astringent and detergent— <i>Khory</i>	Traumatic— <i>Steel</i> . Excitant, deodorizer— <i>Tuon</i>	2 drs. to 1 oz.	1 to 4 tolas		4 drs.	Gum resinous exudation from the stem of Balsamodendron myrrha— <i>Tuon</i>
Nutmeg	Jaephul	အဒိဂြိုဟ်ဝမ်း	Carminative— <i>Symm</i> . Stimulant, digestive tonic, astringent— <i>Khory</i>			4 to 6 tolas		1 to 4 drs.	Seeds of myristica officinalis
Nux vomica	Kuchila— <i>Symm</i> . Kuchila— <i>Khory</i>	ခပေါင်း	Nervine tonic— <i>Steel</i> . Stimulant— <i>Symm</i> . Astringent— <i>Khory</i> . In chronic rheumatism, paralysis, chronic diarrhoea and dysentery. Good vermifuge— <i>Khory</i>		½ to 2 drs.	½ to 2 tolas	½ to 2 drs.	½ to 1½ drs.	Seeds of strychnos nux vomica
Oil, cinnamon	Darchinul ka tel, taj ka tel	ဘင်ကြိုးဆီ	Stimulant. In diarrhoea— <i>Khory</i> . Anthrax.	Stimulant, rubefacient— <i>Khory</i>				1 dr.	Oil from cinamomum zeylanicum
Olive oil	...	ထံထွင်းဆီ	Laxative, nutritive, emollient, vehicle— <i>Tuon</i>	Emollient vehicle— <i>Tuon</i>					From Olea Europaea
Oil of turpentine ...	Tarpla tel	တာထပြင်ဆီ	Diuretic, stimulant— <i>Steel</i> . Astringent, diaphoretic, anti-spasmodic, antihelmintic, cathartic— <i>Tuon</i>	Stimulant— <i>Steel</i> . Vesicant, counter-irritant, digestive	5 ozs. 2 drs.; 1 oz. — <i>Steel</i> & <i>Symonds</i>			2 ozs.	From Pinus palustris and others
Oleander, sweet	Kanil or karbi— <i>Steel</i> . Lal kaneri— <i>Symm</i>	...	Excitant, tonic, slightly narcotic, anti-periodic; bark— <i>Steel</i>	In irritable and sloughy wounds, bruises and burns; in form of poultice	1 to 6 drs.				Root, bark and flowers of nerium odorum
Onions	Pecna	ကြက်သွန်နီ	Digestive, diuretic, has more action on kidneys than garlic; may be given to animals exposed to a chill; stimulant— <i>Steel</i> . In colic— <i>Khory</i>	When roasted its poultice applied to inflamed and indolent boils— <i>Khory</i>	8 lbs. (Hawker)	1 to 3 seers	1 to 3 seers	10 lbs.	Bulb of allium cepa
Opium	Afeem	ဝိန်း	Narcotic— <i>Anodyne</i> — <i>Steel</i> . Stimulant, sedative, anti-spasmodic— <i>Tuon</i>	Anodyne	½ to 1 oz.	½ to 4 tolas		2 drs. to 1 oz.	Papaver somniferum
Opium tincture	Afeem ka arak	ဝိန်းရည်	Anodyne, hypnotic, sedative, anti-spasmodic— <i>Tuon</i>	Anodyne. In enemas in diarrhoea				3 ozs.	Laudanum
Papaw tree leaves	Papaya— <i>Steel</i> . Papaya ka putta— <i>Khory</i>	သထောရွက်	The remedy par excellence in capped elbow and other fibrous tumours; detergent— <i>Steel</i>	The remedy par excellence in capped elbow and other fibrous tumours; detergent— <i>Steel</i>					Carica papaya
Papaw tree juice	...	သထောရေ	Vermifuge, especially for lumbrici	Digestive— <i>Steel</i> . Locally in chronic eczema; its application (as a paint) with borax water is highly prized	3 drs. for horses. May be tried in same dose ½ to 1 oz.				
Pepper, black	Kali mirchi	ငရုတ်ကောင်း	Stimulant— <i>Steel</i> . Carminative— <i>Symm</i> . Stomachic, aromatic— <i>Tuon</i> . Resolvent, tonic, anti-periodic— <i>Khory</i>	Stimulant	½ to 1 oz.	2 to 8 tolas		½ oz. to 6 drs.	Berries of piper nigrum
Pepper, long	Piplee	ပိတ်ချင်း	Tonic, carminative, stomachic— <i>Symm</i> . Stimulant, in debility— <i>Steel</i> . Gilchrist recommends it in guarrass and chowring. In chronic cough— <i>Khory</i>	In obstinate ulcers; combined with onions— <i>Steel</i> , <i>Gilchrist</i>	½ to 2 ozs.	2 to 8 tolas	½ to 3 ozs.	½ oz. to 6 drs.	Fruit of piper longus
Peppermint	Pudina	...	Carminative— <i>Steel</i> . In diarrhoea, debility and colic— <i>Gilchrist</i>	...			1 lb.		Mentha piperita
Phenyle	...	...	...	Antiseptic, disinfectant, and deodorizer					
Pimenta	...	...	Aromatic, carminative, anti-spasmodic. In indigestion, flatulency, and colic— <i>Tuon</i>	...				½ oz. to 6 drs.	Dried unripe berries of Eugenia pimenta— <i>Tuon</i>

LIST OF DRUGS.

155

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	Uses.		DOSES.			Remarks.
			Internal.	External.	Steel.	Symm.	Gichrist.	
Piper cubeba	...	...	Carminative, excitant— <i>Symm.</i> Specially valuable in cases of diarrhoea in small doses— <i>Steel</i>	...	$\frac{1}{2}$ to 1 oz.	2 to 8 tolas	...	Fruit of cubeba officinalis
Pix liquida	...	ကတ္တုချလေး	...	Useful for foot sores— <i>Steel</i> . Excitant, rubefacient, anti-leodorizer, antiparasitic— <i>Tuon</i>	...	...	...	Tar
Plantain	...	မှော်ယောဝါး	In musth, urinary disorders, nutritive	...	6 to 12 lbs.	...	...	Fruit of musa paradisiaca
Plantain tree root	...	မှော်ယောဝါး	Diaphoretic— <i>Symm</i>	...	...	3 to 8 seers	...	...
Plantain tree leaves	...	မှော်ယောဝါး	...	Eye-shades, etc.	...	...	...	...
Poppy capsules	...	မှော်ယောဝါး	...	Anodyne as fomentations or poultice to bruised and inflamed parts, or to tender and irritable ulcers, or to eyes in ophthalmia— <i>Khory</i>	...	...	...	Capsules of Papaver somniferum
Potass. bicarbonate	...	...	Antacid, diuretic	...	...	...	...	...
Potass. chlorate	...	...	Mild stimulant, diuretic, refrigerant, in flatulency chiefly— <i>Tuon</i>	Stimulant and refrigerant to unhealthy ulcers	...	...	...	...
Potass. bromide	...	...	Sedative, lowers generative functions in a marked degree	...	...	...	...	...
Potass. nitras	...	မှော်ယောဝါး	Diuretic, febrifuge, refrigerant— <i>Steel, Symm</i>	Refrigerant— <i>Steel</i> . Stimulant to unhealthy wounds— <i>Tuon</i>	$\frac{1}{2}$ to 1 oz.	1 to 3 tolas	...	Nitre, saltpetre
Potass. permanganas.	...	...	...	Deodorizer, disinfectant, excitant to unhealthy wounds— <i>Tuon</i>	...	...	...	...
Potass. permanganas liq.	...	...	...	Cleansing wash for diseased surfaces— <i>Tuon</i> . Disinfectant, deodorizer	...	...	...	Condy's fluid contains 4 grs. to 1 oz.

Potass. iodidi	...	...	...	Alterative, deobstruent, diuretic; in articular rheumatism, dropsy and enlargement of lymphatic glands— <i>Tulun</i> Same as nitrate, diuretic— <i>Finlay Dun</i>	Promotes absorption of tumours and other abnormal growths	...	...	2 drs.
Potass. acetate	...	...	...	Astringent— <i>Steel</i> . Vermifuge, stomachic— <i>Khory</i> . In chronic diarrhoea and dysentery	...	...	...	2 to 3 drs.
Pomegranate fruit	Anar darum— <i>Khory</i>	...	ယထိသီးခွံ	Antacid for tonia— <i>Steel</i> . Specific in tape-worms— <i>Khory</i>	...	...	...	6 drs. to 3 ozs.
Pomegranate root, bark.	...	...	ယထဲမြစ်ခေါင်	Tonic, anti-periodic. In loss of appetite, weak digestion, debility, acute rheumatism	...	...	...	1 to 2 drs.
Quinine sulph.	...	...	...	Diuretic— <i>Steel</i>	...	...	...	6 to 24 lbs.
Radish	Mula— <i>Khory</i> . Moolkee— <i>Steel</i>	...	မုန်ထာဥ	Diuretic— <i>Steel</i> . Astringent— <i>Khory</i>	Adhesive— <i>Steel</i> . Excitant, astringent, styptic— <i>Tulun</i>	3 to 12 seers	...	1 to 2 ozs.
Resin	Dhuna— <i>Steel</i> . Ral rosina— <i>Khory</i>	...	ထင်းရှူးဆီ	...	Stimulant to wounds, blistered surfaces— <i>Tulun</i>	1 to 4 ozs.	...	Rhapianus sativus
Resin ointment	...	...	ထင်း ရှူးဆီ ဝဲယောင်းချက်	...	...	...	...	...
Rhubarb	Revunchine— <i>Slynn</i>	...	...	Tonic, refrigerant, stomachic— <i>Slynn</i>	...	...	...	Dried roots of species of Rheum
Salt, common	Nimuck	...	ဆား	Tonic, vermifuge, nutrient— <i>Steel</i> . Cathartic, diuretic, alterative, resolvent	Stimulant in chronic sprains	1 lb.	...	Table salt. Chloride of sodium
Salt, enema	...	...	...	...	Laxative, vermifuge	...	...	Bay salt. Chloride of sodium (crude)
Salt, rock	Gumbede— <i>Slynn</i>	...	ယိဉ္ဇာထား	Carminative, stomachic, digestive— <i>Khory</i> . Tonic, refrigerant— <i>Slynn</i>	...	...	...	...
Salt, black	Kala nimuck	...	ဆားထုတ်	Digestive— <i>Slynn</i>	...	...	...	...
Snake roots	(a) Ganadan or limadan or Beligandan— <i>Glichrit</i>	...	...	Anti-periodic, stimulant, tonic in flatulence and debility— <i>Steel</i>	...	...	...	Aristolochia bracteata aristolochia Indica
Soap, bar; soap, hard	Saboon	...	ဆပ်ပြာအခလ	Cathartic, diuretic, antacid, vehicle— <i>Tulun</i>	Stimulant to sprains and contusions, to burns and scalds	3 ozs.	...	1 oz.

List of Drugs employed in the Treatment of Elephants—continued.

156

A TREATISE ON ELEPHANTS.

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Symm.	Gilchrist.	—	
Piper cubeba ...	Cabaub chinse— <i>Steel</i> , Si-chini— <i>Khory</i>	...	Carminative, excitant— <i>Symm</i> . Specially valuable in cases of catarrh in small doses— <i>Steel</i>	...	$\frac{1}{2}$ to 1 oz.	2 to 3 tolas	...	...	Fruits of cubeba officinalis
Pix liquida ...	Kil suktra ...	ကတ္တုရေ ...	...	Useful for foot sores— <i>Steel</i> . Excitant, rubefacient, anti-deodorizer, parasitic— <i>Fuson</i>	...	...	...	...	Tar
Plantain ...	Monz; kela— <i>Steel</i>	၌ဝ်ပျောသီး ...	In musth, urinary disorders, nutritive	...	6 to 12 lbs.	...	...	Ad lib.	Fruit of musa paradisiaca
Plantain tree root	Monz ka jud	၌ဝ်ပျောခြစ်	Diaphoretic— <i>Symm</i>	...	...	3 to 8 seers	...	...	...
Plantain tree leaves	Monz ka putta	၌ဝ်ပျောရွက်	...	Eye-shades, etc.	...	...	...	...	...
Poppy capsules ...	Posht ...	ပိန်းဆေး ...	...	Anodyne as fomentations or poultice to bruised and inflamed parts, or to tender and irritable ulcers, or to eyes in ophthalmia— <i>Khory</i>	...	...	...	...	Capsules of Papaver somniferum
Potass. bicarbonate	...	...	Antacid, diuretic	...	...	...	...	4 to 6 drs.	...
Potass. chlorate ...	...	...	Mild stimulant, diuretic, refrigerant, in flatulency chiefly— <i>Fuson</i>	Stimulant and refrigerant to unhealthy ulcers	...	...	...	2 to 4 drs.	...
Potass. bromide ...	...	...	Sedative; lowers generative functions in a marked degree	...	...	...	...	4 to 6 drs.	...
Potass. nitras ...	Shora— <i>Steel</i>	ယဉ်းပိန်း ...	Diuretic, febrifuge, refrigerant— <i>Steel</i> , <i>Symm</i>	Refrigerant— <i>Steel</i> . Stimulant to unhealthy wounds— <i>Fuson</i>	$\frac{1}{2}$ to 1 oz.	1 to 3 tolas	...	$\frac{1}{2}$ to 1 oz.	Nitre, saltpetre
Potass. perman-ganas.	...	...	...	Deodorizer, disinfectant, excitant to unhealthy wounds— <i>Fuson</i>	...	...	...	...	Condy's fluid contains 4 grs. to 1 oz.
Potass. perman-ganas liq.	...	...	...	Cleansing wash for diseased surfaces— <i>Fuson</i> . Disinfectant, deodorizer	...	...	...	...	...

Potass. iodidi ...	...	...	Alterative, deobstruent, diuretic: In articular rheumatism, dropsy and enlargement of lymphatic glands— <i>Fuson</i>	Promotes absorption of tumours and other abnormal growths	...	...	...	2 drs.	...
Potass. acetate ...	...	...	Same as nitrate, diuretic— <i>Finsky Dun</i>	...	...	...	...	2 to 3 drs.	...
Pomegranate rind	Anar darum— <i>Khory</i>	သစ်သီးခွံ ...	Astringent— <i>Steel</i> . Vermifuge, stomachic— <i>Khory</i> . In chronic diarrhoea and dysentery	...	...	...	...	6 drs. to 3 ozs.	Punica granatum (rind of the fruit)
Pomegranate root, bark.	...	သစ်ခြစ်ခေါက်	Anthelmintic for tænia— <i>Steel</i> . Specific in tape-worms— <i>Khory</i>	...	...	2 to 6 tolas	...	...	...
Quinine sulph.	...	...	Tonic, anti-periodic. In loss of appetite, weak digestion, debility, acute rheumatism	...	...	...	...	1 to 2 drs.	...
Radish ...	Mula— <i>Khory</i> . Noolce— <i>Steel</i>	မုရ်လာ ...	Diuretic— <i>Steel</i>	...	6 to 24 lbs.	3 to 12 seers	...	6 to 24 lbs.	Rhaphanus sativus
Resin ...	Dhuna— <i>Steel</i> . Rai rosina— <i>Khory</i>	ထင်းရှူးဆီ ...	Diuretic— <i>Steel</i> . Astringent— <i>Khory</i>	Adhesive— <i>Steel</i> . Excitant, astringent, styptic— <i>Fuson</i>	1 to 4 ozs.	...	...	1 to 2 ozs.	...
Resin ointment ...	...	ထင်းရှူးဆီ ဝယောင်ချက်	...	Stimulant to Wounds, blistered surfaces— <i>Fuson</i>	...	...	...	...	...
Rhubarb ...	Revunchnee— <i>Symm</i>	...	Tonic, refrigerant, stomachic— <i>Symm</i>	...	...	$\frac{1}{2}$ to 1 seer	...	...	Dried roots of species of Rheum
Salt, common ...	Nimuck ...	ယား ...	Tonic, vermifuge, nutrient— <i>Steel</i> . Cathartic, diuretic, alterative, resolvent	Stimulant in chronic sprains	1 lb.	16 to 30 ozs.	...	$\frac{1}{2}$ to 1 lb.	Table salt. Chloride of sodium
Salt, enema ...	...	...	...	Laxative, vermifuge	...	$\frac{1}{2}$ to 2 tolas	...	...	Bay salt. Chloride of sodium (crude)
Salt, rock ...	Gumbeede— <i>Symm</i>	ယိုးဒယား ...	Carminative, stomachic, digestive— <i>Khory</i> . Tonic, refrigerant— <i>Symm</i>	...	...	...	...	...	...
Salt, black ...	Kala nimuck	ယားနက် ...	Digestive— <i>Symm</i>	...	...	10 to 20 ozs.	...	2 to 4 ozs.	...
Snake roots ...	(a) Ganadan or kiram or Belgan dan— <i>Gilchrist</i>	...	Anti-periodic, stimulant, tonic in flatulence and debility— <i>Steel</i>	...	3 ozs.	...	...	...	Aristolochia bracteata aristolochia India
Soap, bar; snop, hard ...	Sabeon ...	ဆပ်ပြာဆော ...	Cathartic, diuretic, antacid, vehicle— <i>Fuson</i>	Stimulant to sprains and contusions, to burns and scalds	...	...	...	1 oz.	...

LIST OF DRUGS.

157

List of Drugs employed in the Treatment of Elephants—continued.

Drugs.	Hindustani.	Burmese.	Ussa.		Dossa.			Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	
Soap, country	... Sahoon	... ကုလားဆင်ပြာ	Anthelmintic. In lungun— <i>Steel</i>	Detergent— <i>Steel, Slymm</i> ...	1 to 6 drs.	...	$\frac{1}{2}$ to 3 tolas	1 oz.
Soap, enema	...	...	...	Purgative	...	...	...	...
Soap lint. co.	...	...	...	Stimulant, anodyne, to sprains, sore-throat. etc. — <i>Tuon</i>	...	...	...	...
Soap nuts	... Rita	... ကံင်ပွန်းဆိး	Refrigerant— <i>Steel, Slymm</i> . Purgative— <i>Steel, Tuon</i> . Expectorant, diuretic, tonic. In colic, flatulence, etc.— <i>Steel</i>	Detergent— <i>Steel</i> ...	$\frac{1}{2}$ to 2 lbs.; 1 to 2 seers	$\frac{1}{2}$ to 2 seers	...	Sap. lauri folios
Soap, soft	...	... ဆင်ပြာချေ	...	Stimulant, detergent, lubri- cant, cleansing. To burns and scalds	...	...	...	...
Sodæ bicarb.	...	...	Antacid, diuretic	...	...	...	...	$\frac{1}{2}$ oz.
Sodæ carb.	...	...	Do.	...	...	...	...	2 drs.
Sodæ hyposulphite	...	...	Antiseptic, disinfectant, alterative. In indiges- tion, flatulence, anthrax— <i>Tuon</i>	Antiseptic, disinfectant, deodorizer— <i>Tuon</i> . Pha- geutic sores and ulcers	...	...	...	2 to 6 drs.
Sodæ sulphite	...	...	Do.	...	...	...	...	2 ozs.
Spearmint	... Poodina— <i>Steel</i>	...	Carminative — <i>Steel</i> , <i>Slymm</i> . In diarrhoea, debility and colic	...	...	$\frac{1}{2}$ to 1 seer	About a lb.	Mentha viridis
Spirits, aether	...	...	Diffusible stimulant, anti- spasmodic— <i>Tuon</i>	...	...	...	...	Sulphuric aether
Spirit, aether nitros	...	...	Stimulant, anti-spasmodic, diuretic, diaphoretic— <i>Tuon</i>	...	...	...	...	Sweet spirits of nitre. Nitrons aether

Spirit ammoniac	...	...	Diffusible stimulant, antacid, anti-spasmodic— <i>Tuon</i>	...	...	...	1½ to 2 ozs.	Sweet spirits of ammonia. Aromatic spirits of ammonia. Sal volatile
Spirit camphor	...	...	Do.	Stimulant, anodyne, discutient— <i>Tuon</i>	...	...	...	Strength 1 to 4
Spirit rectificatus	...	...	Stimulant, diuretic, diaphoretic— <i>Tuon</i>	Added to cooling lotions to increase their refrigerating power and in preparing finctures	...	...	...	Spirits of wine
Squills, Indian	...	...	Young bulbs only useful, old bearing little or no action. In stranguary and fever— <i>Steel</i>	...	...	...	2 drs.	Urginea Indica and Scilla
Sugar, coarse	...	သကြား	Vehicle	...	...	...	...	...
Subnitrate of bismuth	...	...	See Bismuth	...	...	...	Ad lib.	...
Sulphur	...	ကန့်	Alterative— <i>Steel</i> , <i>Slymm</i> . Laxative— <i>Slymm</i> . Diaphoretic— <i>Slymm</i> . In rheumatism— <i>Tuon</i>	Disinfectant, deodorizer when burnt	2 to 2½ ozs.	2 to 6 tolas	3 ozs.	...
Sulphur ointment	...	ကန့် ဖလောင်းချက်	...	In skin affection	...	...	...	...
Suttoo	...	...	Nutrient, demulcent, vehicle— <i>Steel</i>	...	(About a lb.) ad lib.	...	...	Mixture of gram and barley flours
Sweet flag	...	...	Stomachic, aromatic, antiperiodic, tonic, stimulant— <i>Steel</i>	In chronic rheumatism. Anti-parasitic, for fleas	...	...	...	Rhizome of acorus calamus
Tar ointment	...	ကတ္တလ်ဇေး ဖလောင်းချက်	...	For cracks and foot dressing	...	...	...	...
Tamarind pulp	...	Amhl — <i>Steel</i> . Imhl — <i>Khory</i>	Laxative— <i>Steel</i> . Refrigerant— <i>Steel</i> , <i>Slymm</i> . Diuretic— <i>Steel</i> , <i>Slymm</i> . Cooling aperient— <i>Slymm</i> . Vehicle	Vehicle	6 ozs.	6 to 12 tolas	8 ozs. to 1 lb.	Ripe fruit of Tamarindus Indica
Thymol	...	...	Antibilious, anti-scorbutic, carminative, digestive, quenches thirst— <i>Khory</i>	Antiseptic, disinfectant	...	...	...	...

List of Drugs employed in the Treatment of Elephants—continued.

158

A TREATISE ON ELEPHANTS.

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	—	
Soap, country	Sahoon	ကုသားဆင်ပြာ	Anthelmintic. In lungun— <i>Steel</i>	Detergent— <i>Steel, Slymm</i>	1 to 6 drs.	...	$\frac{1}{2}$ to 3 tolas	1 oz.	
Soap, enema	...	...	...	Purgative	...	...	...	...	
Soap list. co.	...	...	...	Stimulant, anodyne, to sprains, sore-throat, etc.— <i>Tuon</i>	...	...	...	...	
Soap nuts	Rita	ကပ်ပွန်းသီး	Refrigerant— <i>Steel, Slymm</i> . Purgative— <i>Steel</i> . Laxative, diuretic, tonic. In colic, flatulence, etc.— <i>Steel</i>	Detergent— <i>Steel</i>	$\frac{1}{2}$ to 2 lbs.; 1 to 3 seers	$\frac{1}{2}$ to 2 seers	...	...	Sap. lauri folius
Soap, soft	...	ဆင်ပြာချော့	...	Stimulant, detergent, lubricant, cleansing. To burns and scalds	...	...	...	$\frac{1}{2}$ oz.	
Soda bicarb.	...	...	Antacid, diuretic	...	...	...	...	2 drs.	
Soda carb.	...	...	Do.	...	...	...	...	2 to 6 drs.	
Soda hyposulphite	...	...	Antiseptic, disinfectant, alterative. In indigestion, flatulence, anthrax— <i>Tuon</i>	Antiseptic, disinfectant, deodorizer— <i>Tuon</i> . Phagoleptic sores and ulcers	...	...	...	2 ozs.	
Soda sulphite	...	...	Do.	...	...	...	...	...	
Spearmint	Poodina— <i>Steel</i>	...	Carminative — <i>Steel, Slymm</i> . In diarrhoea, debility and colic	...	...	$\frac{1}{2}$ to 1 seer	About a lb.	...	Mentha viridis
Spirits, aether	...	...	Diffusible stimulant, anti-spasmodic— <i>Tuon</i>	...	...	...	...	...	Sulphuric aether
Spirit, aether nitros	...	...	Stimulant, anti-spasmodic, diuretic, diaphoretic— <i>Tuon</i>	...	...	...	...	3 to 4 ozs.	Sweet spirits of nitre. Nitrous aether
Spirit ammon., aromatic	...	...	Diffusible stimulant, antacid, anti-spasmodic— <i>Tuon</i>	...	...	...	...	$\frac{1}{2}$ to 2 ozs.	Sweet spirits of ammonia. Aromatic spirits of ammonia. Sal volatile
Spirit camphor	...	...	Do.	Stimulant, anodyne, discutient— <i>Tuon</i>	...	...	...	...	Strength 1 to 4
Spirit rectificatus	...	...	Stimulant, diuretic, diaphoretic— <i>Tuon</i>	Added to cooling lotions to increase their refrigerating power and in preparing tinctures	...	...	...	...	Spirits of wine
Squilla, Indian	Jangli kana	...	Young bulbs only useful, old bearing little or no action. In strangury and fever— <i>Steel</i>	...	$\frac{1}{2}$ to 1 oz.	...	...	2 drs.	Urginea Indica and Scilla
Sugar, coarse	Suckur	ထကြား	Vehicle	...	Ad lib.	...	...	...	
Subnitrate bismuth	of	...	See Bismuth	...	...	...	...	...	
Sulphur	Gandhak	ကန့်	Alterative— <i>Steel, Slymm</i> . Laxative— <i>Slymm</i> . Diaphoretic— <i>Slymm</i> . In rheumatism— <i>Tuon</i>	Disinfectant, deodorizer when burnt	2 to 2½ ozs.	2 to 6 tolas	...	1 ozs.	
Sulphur ointment	...	ကန့် ဖယောင်းချက်	...	In skin affection.	...	...	...	...	
Suttoo	Suttoo	...	Nutritive, demulcent, vehicle— <i>Steel</i>	...	(About a lb.) ad lib.	...	...	...	Mixture of gram and barley flour
Sweet flag	Bach, butch or goor butch— <i>Steel</i>	...	Stomachic, aromatic, antiperiodic, tonic, stimulant— <i>Steel</i>	In chronic rheumatism. Anti-parasitic, for fleas	$\frac{1}{2}$ to 1 oz.	...	...	...	Rhizome of acorns calamus
Tar ointment	...	ထကြားဖယောင်းချက်	...	For cracks and foot dressing	...	...	...	...	
Tamarind pulp	Ambli— <i>Steel</i> . Imhli— <i>Khory</i>	မန်ကျည်းသီး	Laxative— <i>Steel</i> . Refrigerant— <i>Steel, Slymm</i> . Diuretic— <i>Steel, Slymm</i> . Cooling aperient— <i>Slymm</i> . Vehicle	Vehicle	6 ozs.	6 to 12 tolas	...	8 ozs. to 1 lb.	Ripe fruit of Tamarindus Indica
Thymol	...	...	Antibilious, anti-scorbutic, carminative, digestive, quenches thirst— <i>Khory</i>	Antiseptic, disinfectant	...	...	...	$\frac{1}{2}$ to 2 drs.	

LIST OF DRUGS.

159

List of Drugs employed in the Treatment of Elephants—concluded.

Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Symm.	Gilchrist.	—	
Tobacco decoction	...	...	Antidote to nux vomica ; strychnia	Antiseptic, disinfectant	...	...	...	...	Nicotiana tabacum
Tobacco leaves	Tumliakoo	သေးရွက်ရည် သေးရွက်	Sedative, anodyne, valuable in cases of stranguy of urine and obstinate spasm of the bowels. In tetanus, colic ; relieves constipation— <i>Steel</i> . Narcotic, purgative— <i>Symm</i>	Anodyne, especially useful in allaying cutaneous furor	...	၁ to ၁ tola	1 to 1½ drs.	...	...
Tobacco infusion	...	...	...	Parasiticide— <i>Steel</i> , <i>Tuon</i> . Applied to sore feet of elephants— <i>Steel</i>	...	...	...	...	...
Treacle	Goor	တင်ပဲ	Laxative, vehicle, hastens activity of cathartics	...	...	...	...	...	Molasses
Turmeric	Huldee	နီနွဲ့ငွေတင်	Aromatic, stimulant, mild tonic— <i>Steel</i>	Fumes of burning turmeric useful as an inhalation in catarrh, and a decoction has a beneficial effect in ophthalmia— <i>Steel</i>	...	...	2 to 4 ozs.	½ to 1 oz.	Rhizome of Curcuma longa— <i>Steel</i>
Ujwan of Ajwan, these kinds— <i>Steel</i>	...	...	...	...	...	...	...	...	Carni fructus
Ujwan or Onam	...	...	...	...	...	...	...	...	Cleome visca
Ujwan or Shoree	...	...	...	...	...	...	...	...	Hypocyanus or Henbane seeds
Ujwan Khorasani— <i>Steel</i>	...	...	...	...	...	...	...	...	Psychotis ajorvan (fruits of)
Ujman	Ajmanau— <i>Steel</i>	...	Stimulant, aromatic, tonic, especially useful in diarrhoea and indigestion with flatulence— <i>Steel</i> . Carminative, stomachic— <i>Symm</i> . Anti-spasmodic— <i>Steel</i> . In colic, bronchitis	...	½ to 1 oz. ; 2 to 8 tolas	...	...	...	...

Verdigris	...	Zangar	...	ကြေးသီး	...	Tonic, astringent— <i>Tuon</i>	Stimulant to wounds— <i>Steel, Slynn</i>	...	...	...	...	Cupri subacetat
Vinegar	...	Sirka	...	...	...	<i>See Acetum</i>						
Wax	...	Mom	...	မုတု	...	...	Adhesive — <i>Steel</i> . Emollient	<i>Ad Hib.</i>	...	...	...	
Wheat flour	...	Geong ka atta	...	ဂျုံ	...	Vehicle, nutrient	...					
Zinc chloride, liq.	...	...	...	...	...	...	Caustic, astringent, deodorizer, disinfectant; stimulant to wounds, unhealthy ulcers, in eczema	...	...	...	...	Sir William Bur-
Zinc oxide	...	...	...	...	...	...	Desiccant, astringent					nett's disinfect-
Zinc ointment	...	...	...	...	...	...	Astringent. In slight ex-	...	...	...	...	coring fluid contains
Zinc sulphate	...	Suffed tuta— <i>Steel</i>	...	ဒုတ္တ	...	Astringent, tonic	coriations and ulcerations— <i>Tuon</i>	2 to 4	...	...	...	200 grains to the
Zinc lotion	...	...	...	ဒုတ္တ	...	...	Astringent, excitant mild escharotic, and desiccant when applied to wounds. Collyrium injected into sinuses and in quitor according to strength used	drs.	...	...	...	ounce

List of Drugs employed in the Treatment of Elephants—concluded.

160

A TREATISE ON ELEPHANTS.

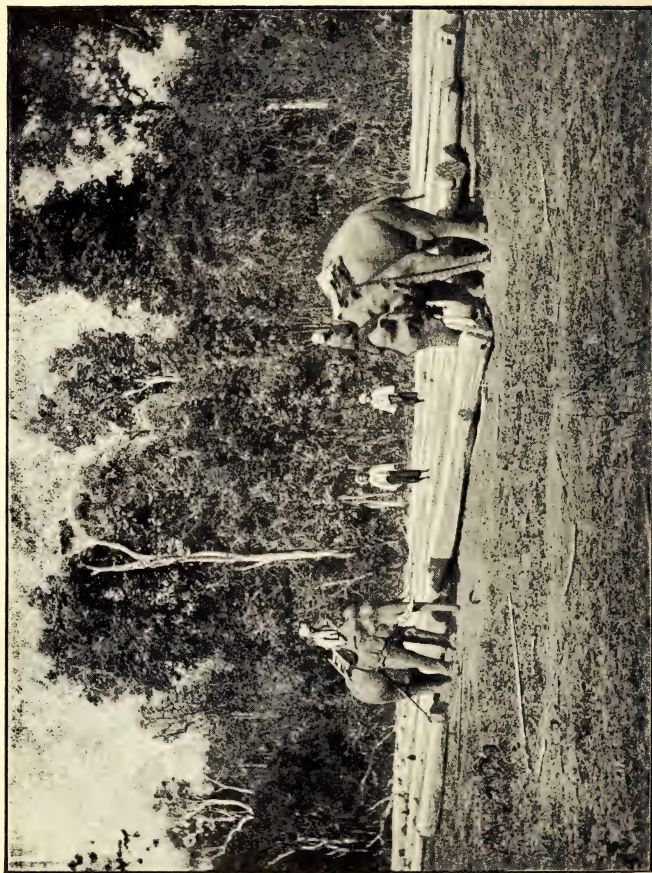
Drugs.	Hindustani.	Burmese.	Uses.		Doses.				Remarks.
			Internal.	External.	Steel.	Slymm.	Gilchrist.	—	
Tobacco decoction	...	ဆေးရွက်ရည်	Antidote to nux vomica ; strychnia	Antiseptic, disinfectant	...	...	...	...	Nicotiana tabacum
Tobacco leaves	Tumhako	ဆေးရွက်	Sedative, anodyne, valuable in cases of stranguy of urine and obstinate spasm of the bowels. In tetanus, colic ; relieves constipation— <i>Steel</i> . Narcotic, purgative— <i>Slymm</i>	Anodyne, especially useful in allaying cutaneous furor	...	$\frac{1}{2}$ to $\frac{1}{2}$ tola	1 to 1½ drs.	...	
Tobacco infusion	...	...	...	Parasiticide— <i>Steel</i> , <i>Tuson</i> . Applied to sore feet of elephants— <i>Steel</i>	...	...	...	...	
Treacle	Goor	ထင်ထ	Laxative, vehicle, hastens activity of cathartics	...	...	...	...	...	Molasses
Turmeric	Huldee	နံနွင်းတက်	Aromatic, stimulant, mild tonic— <i>Steel</i>	Fumes of burning turmeric useful as an inhalation in catarrh, and a decoction has a beneficial effect in ophthalmia— <i>Steel</i>	...	...	2 to 4 ozs.	$\frac{1}{2}$ to 1 oz.	Rhizome of Curcuma longa— <i>Steel</i>
Ujwan of Ajwan, three kinds—	...	...	...	...	...	...	...	...	Carni fructus
Ujwan or Omam	...	...	...	...	...	...	...	...	Cleome visca
Ujwan or Shoree	...	...	...	...	...	...	...	...	Hyoscyamus or Henbane seeds
Ujwan Khorasani— <i>Steel</i>	...	...	...	...	...	...	...	...	Ptychotis ajorvan (fruits of)
Ujman	Ajman— <i>Steel</i>	...	Stimulant, aromatic, tonic, especially useful in diarrhoea and indigestion with flatulence— <i>Steel</i> . Carminative, stomachic— <i>Slymm</i> . Anti-spasmodic— <i>Khory</i> . In colic, bronchitis	...	$\frac{1}{2}$ to 1 oz. ; 2 to 8 tolas	...	...	...	...

Verdigris	Zangar	ကြေးညို	Tonic, astringent— <i>Tuson</i>	Stimulant to wounds— <i>Steel</i> . Escharotic— <i>Slymm</i>	...	...	...	...	Cupri subacetates
Vinegar	Sirka	...	See Acetum	...	...	...	...	...	...
Wax	Mom	မရောင်း	...	Adhesive— <i>Steel</i> . Emollient	...	...	...	...	...
Wheat flour	Geong ka atta	ဂျိန်း	Vehicle, nutrient	...	Ad lib.	...	...	...	...
Zinc chloride, liq.	...	...	...	Caustic, astringent, deodorizer, disinfectant ; stimulant to wounds, unhealthy ulcers, in eczema	...	...	...	...	Sir William Burnett's disinfecting fluid contains 200 grains to the ounce
Zinc oxide	...	...	...	Desiccant, astringent	...	...	...	...	
Zinc ointment	...	...	...	Astringent. In slight excoriations and ulcerations— <i>Tuson</i>	...	...	...	...	
Zinc sulphate	Suffed tuta— <i>Steel</i>	ဒုတ္တ	Astringent, tonic	...	2 to 4 drs.	...	...	2 drs.	
Zinc lotion	...	ဒုတ္တရည်	...	Astringent, excitant, mild escharotic, and desiccant when applied to wounds. Collyrium injected into sinuses and in quilter according to strength used	...	...	...	...	

LIST OF DRUGS.

161

PLATE VIII.



OUNGING AND DRAGGING.

PART IV.

Non-infective Diseases.

CHAPTER I.

GENERAL TREATMENT OF SICKNESS.

IT will be as well to remark here that elephants generally are bad patients from three points of view : (a) they are naturally very timid suspicious creatures, difficult and often dangerous for strangers to handle ; (b) their vital processes are slow, hence diseases run a protracted course, take a low form and loss of condition is only slowly regained. Their natural timidity in health is often augmented by disease ; they very readily lose heart, becoming indifferent or oblivious to their surroundings in serious ailments ; (c) the difficulty usually encountered in the administration of medicines.

If successful treatment is to be achieved, these facts must never be lost sight of, everything calculated to frighten the patient should be as far as possible avoided and every effort to conciliate and gain his confidence employed in preference to any method of restraint to effect one's purpose. Restraint in any form increases his fears, stimulates him to offer resistance and exhausts his energies. For this reason it is advised that the details of treatment laid down by the person in charge should be carried out under his personal supervision through the agency of the *oasis* alone.

(1) *Rest*.—Whenever any indication of ill-health, however trivial, is observed, the first step in treatment is to rest the animal and by rest is meant that except for gentle walking exercise, if not lame, the animal must be tethered and not allowed to travel or work on any pretext whatever until such time as the person in charge is satisfied that the animal is fit to do so.

(2) *Shelter*.—During the hot season a cool and shady standing must be selected. In the rains he must be kept out of the wet and not exposed to cold winds. Should an animal show signs of chilliness, some sort of covering should be thrown over him or massage may be practised. Burmans, Karens and Shans usually employ this latter method, which they perform with their hands and feet and which appears to afford the patient comfort.

(3) *Food*.—All grain ration should be withheld. In most diseases the appetite is partially or wholly lost and it is therefore

necessary to tempt the patient with some favourite fodder, small quantities of which should be presented frequently, such as leaves and boughs of favourite trees well-known to attendants, plantain stems, bamboos, maize or millet stalks in or out of ear, sugarcane or fruits such as pineapples, plantains, bael, green cocoanuts, etc.,—in fact anything that he can be enticed to eat.

(4) *Drink*.—Unless the water-supply is in the immediate vicinity, elephants should not be taken long distances to drink or bathe, but arrangements must be made to carry this out near the standings. It is always desirable to have a tubful of fresh clean water at the standing as well. As much *freshly* made cold gruel as they will take should be offered in bucketsful. Gruel rapidly turns sour in this country, hence it should not be made a long time before offering, also every care should be taken that it is presented in clean vessels.

(5) *Excretions*.—The dung must always be carefully examined daily and especial attention paid to the *early detection of parasites* which are often so small as to be easily overlooked. Many animals die every year from want of attention to this important matter, parasites often not being detected until the animal is passing them in thousands, has serious diarrhœa, and has become so enfeebled as to render treatment futile. The urine too must be daily examined and departures from health as mentioned under “Urinary system” reported.

(6) *Standings*.—Important as it is under ordinary circumstances to keep standings and surroundings in a thoroughly clean state, it is still more necessary to do so during any sickness. Offensive gases emanate from collections of dung and litter, which are themselves unwholesome and these in addition attract flies, causing annoyance to the sick creature as well as materially aiding in the spread of infection. When disinfectants can be procured—and there are many inexpensive ones on the market—they should be freely used to purify standings. Once a week the sick animal should be removed to a fresh standing if it is only 30 or 40 yards distant. It is also a wise precaution to *isolate all sick animals*. All animals suffering from wounds and abscesses should as much as possible be kept on standings free from sand and dust, owing to the habit elephants have of taking up dust and dirt in their trunks and blowing it over abraded surfaces.

(7) *Convalescence*.—When once an animal has regained a certain amount of strength so that he is able to roam about, he should be taken to suitable jungle, sufficiently fettered to prevent his being lost and let loose. By this means an animal has the opportunity of satisfying his own inclinations with regard to the nature, quality and quantity of his food, and there is no method of treatment that will advance and restore his usual health and vigour with the same rapidity.

CHAPTER II.

GENERAL INDICATIONS OF ILL-HEALTH.

After what has been said about the elephant in health, it will be as well before discussing individual diseases to enumerate some of the major indications of indisposition commonly displayed:—

(1) *Dulness*.—This is probably the first indication likely to attract notice and is shown by the cessation of the usual restless movements of the trunk, ears, limbs and body so characteristic of health, and should at once be detected by any observant attendant. This symptom is evinced in most constitutional disturbances especially the acute diseases. It is also manifested in many local conditions, unless of a trivial character, the detection of which should call for an immediate investigation concerning the temperature, pulse, respirations and excretions.

(2) *Fever*.—Experience has taught me that most of those concerned in the care of elephants have not grasped the vast importance of taking the body temperature. Owners should insist on this being done. Too much stress cannot be laid on this important matter and much loss ensues owing to neglect of this precaution. A special heat-regulating apparatus maintains the body temperature with slight variation at a definite elevation. The production in and loss of heat from the body is to all intents and purposes about equal. If the temperature rises, and this rise is maintained for any time, it shows that this special heat-regulating apparatus is disturbed by some disease; therefore as an aid to diagnosis its significance as a symptom is of considerable moment. In an outbreak of contagious disease the *regular use of the thermometer will more than repay those who take the trouble to avail themselves of this great aid; as one of the very first symptoms is a rise in temperature*, the cases can be treated as suspicious, taken in hand at once and what is still more important early segregation can be enforced thereby, in all probability saving other animals and stamping the disease out. It is desirable whenever possible to take the temperature regularly at the same hour and to record it twice daily, 7 A.M. and 5 P.M. or 8 A.M. and 6 P.M. As a general rule the temperature is slightly lower in the morning than in the evening. Variations of a few tenths of a degree may normally occur in a single day. The temperature of the elephant is normally about

97.4° F. to about 98° F. or 36.6° C. Anything above this constitutes fever and a temperature of 100° F. indicates considerable fever; a rise of four or five degrees a grave condition. Very high temperatures may on rare occasions be met with in heat-stroke, lock jaw and in some contagious diseases. Subnormal temperatures are also uncommon; they are generally met with in cases of severe hæmorrhage and before death.

Fever and high temperature are usually considered synonymous terms, but the latter is only one of the many symptoms connected with the complex condition known as fever. It must be distinctly understood that fever is not a disease in itself: merely a symptom which may arise from manifold conditions. It accompanies almost all acute constitutional ailments resulting from whatever cause, such as anthrax, hæmorrhagic septicæmia and kindred ailments, heat-stroke, chills, all forms of blood poisoning, etc., but may also attend conditions which are purely local, such as an abscess beneath the skin, inflammations, wounds and other injuries. The degree of fever in elephants is measured by the insertion of a thermometer into the rectum; but this is as may be imagined sometimes by no means the easy operation it is in other animals owing to the extreme suspicion and nervousness displayed, in fact it is quite impossible in the case of some animals. The method recommended is as follows: A large number of elephants are not averse from having some of the contents of the rectum evacuated artificially, that is by the *oosi* or mahout inserting his arm previously anointed with some lubricant. A good mahout can generally accomplish this and after having removed some dung can introduce the thermometer without trouble. Another method is to divert suspicion by going through the operation of harnessing or loading, and at the same time offer sweetmeats, sugarcane, etc. As the anus or fundament is surrounded by much loose hanging skin, care must be observed to see that the hand carrying the thermometer is inserted well into the rectum where it should remain for at least a minute. If the animal be worried and excited, the temperature may temporarily be slightly raised. No special thermometer is required: an ordinary clinical thermometer suffices. Hauptner's * "Reform" thermometers are well suited for working with elephants. They are excellent and cheap, are 4" long, with glass scale encased in tube; a cord can be attached. Care should be taken to shake down the mercurial column to 95° F., or if a centigrade thermometer be used, to 35° C. before introducing it. It is necessary to wash a thermometer thoroughly, preferably

* Messrs. Hauptner & Co., Surgical Instrument Makers, N. W. Luisen-Strasse, 53, Berlin.

in a disinfecting solution after use, to obviate the risk of infecting sound animals. Nowadays the centigrade thermometer is coming into general use.

[To convert Fahrenheit into Centigrade, subtract 32, multiply by 5, and divide by 9; and to convert Centigrade into Fahrenheit, multiply by 9 and divide by 5 and add 32.]

Should no thermometer be at hand, there are other indications which after long practice may lead one to a correct conclusion as to the presence of fever; these are—(a) shivering or chill often passed unnoticed is frequently a precursor of fever; (b) uneven surface temperature of the body, *i.e.*, either the trunk, ears or extremities may be cold whilst the body is hot, or may be alternately hot and cold, and the skin of the trunk contracted and shrivelled; (c) loss of appetite; (d) dryness of mouth and evident thirst; (e) constipation; (f) scanty and deep-coloured muddy urine; (g) unusual redness of the membranes of the mouth and palate; (h) watery and red-denied eyes; (i) acceleration of the pulse, which normally beats from 46 to 50 per minute; (k) change of colour of skin which becomes lighter, any white spots about trunk becoming paler; (l) general depression.

Treatment.—It has been already pointed out that fever is a symptom and not a disease, and this being borne in mind, the first indication in regard to treatment is to ascertain if possible its cause, and when this is found to remove it. Until the cause has been discovered, one's energies must be directed towards reducing the temperature to normal limits, and this may be effected in the following ways: First as a matter of routine, a brisk purgative should be given and the bowels must be kept open throughout the attack, *i.e.*, there should be some action of the bowels daily (*see* Formulæ 23 to 38).

It must however be understood that after a strong purgative reaction frequently occurs, during which no dung is passed for several hours; should this extend over a day or two, a repetition of the dose may be given, but in a much milder form or better still enemas may be employed to bring about action of the bowels.

In addition to the instructions laid down for general treatment of sick elephants, the following prescriptions may be tried:—

Nitrate of Potash	...	} $\frac{1}{2}$ oz. of each.
Chlorate of Potash	...	
Rum	...	6 ozs.
Tamarind or jaggery	...	A sufficiency.

Made into a bolus or given in water twice a day.

Nitrate of Potash	...	$\frac{1}{2}$ oz.
Common Salt	...	2 ozs.
Aniseed	...	$\frac{1}{2}$ oz.
Tamarind or jaggery	...	A sufficiency.

Give twice a day in bolus.

Salammoniac	...	} $\frac{1}{2}$ oz. of each.
Cardamoms	...	
Ginger	...	

Give twice daily.

Aconite leaves, powdered	...	3 drs.
Calomel	...	6 drs.
Jaggery	...	8 ozs.

Divide into eight pills ; give one every night.

Also *see* "Diuretics" and "Mussauls."

Any stimulant may be given every few hours.

(3) *Pain*.—This may be suspected when the animal groans frequently without any evident reason. Its locality is sometimes revealed by the behaviour as for instance when pain is in a limb that member is favoured, evidenced by being lifted with caution or carried stiffly during progression; if in the abdomen, manifest uneasiness is shown by frequently lying down and getting up, biting the trunk or keeping the tip in the mouth for some time, or by other unusual behaviour sometimes taking up extraordinary positions, etc.

Treatment.—May be local or general. The former is best practised by the application of heat to the part, and hot water is usually the handiest and best agent to use ; also *see* Part III, Formula 76, and for general treatment *see* Formulæ 1 to 6.

(4) *Appetite*.—May be partially or completely lost, or may be depraved as shown by eating earth, which symptom must be carefully distinguished from a custom amongst many wild animals which visit "salt-licks" and eat earth to obtain salt.

(5) *Debility*.—Like fever is a symptom indicative of disease rather than a disease *per se*, and may be brought about by a multiplicity of causes which may be of a very variable nature, and may be summed up as follows :—

Causes.—(a) *Condition of life*.—From liberty to captivity, necessitating as it does an artificial in lieu of a natural existence.

(b) *Diet*.—Food may be insufficient in quantity, lacking in quality or variety. Salt, a most necessary ingredient, may not be allowed or if allowed may be insufficient, often being appropriated by the attendants (a very frequent fault).

(c) *Overwork*.—Either as regards overtaxing of strength, or to

mild work carried on for many hours at a stretch and therefore curtailing the time for feeding, sleep and rest.

(d) *Insanitary conditions*.—Want of cleanliness in standings, sheds and surroundings.

(e) *Worms*.—That is internal parasites, by depriving the animal of nutriment, or actually robbing him of his blood.

(f) *Abuse of drugs*.—Gilchrist states that this condition may be induced by the excessive use of mercurial preparations which some mahouts undoubtedly are fond of employing.

(g) *Suppurating wounds*.—When these are extensive or chronic, the constant discharges issuing therefrom cause a drain on the system.

Debility in some degree must of necessity accompany all constitutional ailments and is the outcome of profound changes in the constitution of the blood. Every one must have heard the adage "blood is life"; it necessarily follows that the vitality and nutrition of every structure and organ of the body must depend on the quality and quantity of this fluid supplied to them. When this is lacking in quality or quantity, the organs and vital processes from poverty of nutriment are unable to perform their functions as satisfactorily as in health. Debility is directly therefore the outcome of depravity of the blood and is shown in very many ways.

Symptoms: Weakness.—Which may vary from mere listlessness, restlessness at night and unwillingness to work, to prostration or utter helplessness.

2. *Anæmia* (bloodlessness).—Which may vary from slight pallor of the mucous membranes to extreme blanching.

3. *Emaciation*.—Which may only be so slight that the natural depressions and projections of the surface are accentuated, or so pronounced that the beast becomes a skeleton.

4. *The heart*.—Owing to the inferior quality of blood supplied for its own nutrition, becomes weakened and unable to perform its functions satisfactorily, hence those parts furthest removed, especially the tail, and those with paucity of circulation, the ears, may suffer ulceration or actual destruction (mortification). The pulse becomes weak; respiration is hurried, the animal pants on the least exertion, and if pressed may drop dead (heart failure); dropsical swellings, *thut* (ਊਠ), frequently occur owing to the watery condition of the blood permitting a leakage or sweating of this fluid through the walls of the vessels into the tissues surrounding them. The fluid then by force of gravity occupies the most dependent parts. In the case of cavities such as the abdomen, it may collect in large quantities constituting what is known as dropsy. Gilchrist and Forsyth have noted that sores and extensive sloughing of the

external genital organs sometimes occur as a result of this dropsical effusion into the tissues.

The impoverished state of the blood and feeble circulation may sometimes produce sloughing or mortification of a portion of the ears and end of tail.

5. *The digestive apparatus* in like manner suffers, and in consequence we may find loss of appetite or depraved appetite, foetid breath, and not infrequently diarrhoea of a foetid character.

6. *The urinary organs* from the same cause fail in their functions and the characters of the urine may become altered. It may be excessive and clear, or scanty, white, muddy and syrupy.

7. *The skin* too partakes in this general alteration. We find it rough, harsh, scurfy and unduly wrinkled; the hair is readily removed, especially that on the tail, or may fall out; sores may break out on its surface and swellings occur beneath it such as an eruption of boils, particularly on the belly and knee joints, in the condition known to Indians as *sukka zahirbad* (i.e., where dropsy is not a pronounced symptom). The boils may or may not burst. Burmans anxiously watch for the boils to come to a head and burst; if they disappear without bursting they give the animal up.

Debility as seen in its most aggravated form exhibits a train of symptoms almost exactly coinciding with those recorded by many Indian authors under the name of *zahirbad*.

Whether this is a specific disease or not as some would have us believe is a matter of doubt, but the very symptoms noted to characterize that disease are met with in cases of debility pure and simple.

In many ailments of the elephant there is a marked tendency to glandular enlargements and swellings, and in my experience I have come into contact with cases of debility pure and simple which have advanced so rapidly that it has led me to think, as it may have done others, that there was some specific cause. When a number are attacked simultaneously, such suspicions are no doubt justified, but at the same time it must not be lost sight of that the defective conditions in general management, feeding, shelter, may have been shared by all and therefore all may suffer alike.

Owners might help in clearing up much of the present obscurity by recording symptoms and collecting for examination specimens of the blood in fatal cases, the instructions concerning which have been fully laid down in Part V, page 283.

Preventive treatment.—It follows from the remarks made with regard to possible causes, that enquiries must be made into every detail concerning recent general treatment and anything at fault corrected. Early recognition is of the first importance, and any

animal found the least out of condition should be given a rest by sending him away into the jungle.

Curative : (a) General.—Rest from work, gentle walking exercise morning and evening according to strength. The body must be washed daily and kept thoroughly clean. The state of the bowels must be watched and any tendency to constipation corrected by administration of laxatives (*see* Formulæ—Laxatives or aperients, 23 to 28, or Enemas, 77 to 80).

Thirst should be relieved by always keeping a tub of fresh water near the standing. A liberal allowance of good food, which must occasionally be varied, and also an allowance of salt is necessary, in addition to which tempting diet such as sugarcane, fruit, may be given with advantage as also wheaten cakes or *chupatties* or bread, 5 or 6 lbs., morning and evening. Diuretics (*see* Formulæ 16 to 22) may be tried, and if the appetite is bad, Cordials (*see* Formulæ 11 to 15) and stimulants such as rum or whisky in 8-ounce doses twice or thrice daily should be given. In most diseases of elephants the use of stimulants is to be advocated, as being an animal of a lymphatic nature the exhibition of medicines of this class do not seem to have an ill-effect at any time. During convalescence a course of tonics is indicated, especially the preparations of arsenic, iron or copper mixed with vegetable bitters or aromatics—*see* Formulæ 39 to 46. Also dilute nitric acid in doses of one to three drachms in a bucket of water, or dilute sulphuric acid in similar doses once daily, or iodide of iron in 2-drachm doses once a day.

If worms are the cause, for treatment *see* Part III, Formulæ 47 to 53.

(b) *Local.*—When the dropsy under the skin of the belly tends to become tense and the area is extensive, the skin may be stabbed in several places to allow the fluid to drain away. This is best done by protecting a knife by winding round the blade, tow, cloth, or string, so as to leave only half to three-quarters of an inch of the blade exposed, so that when stabbing the part it cannot go deep enough to cause injury. The stabs should be four or five inches apart. This done, the parts should be fomented and afterwards dressed with anti-fly preparations—*see* Formulæ 122, 123, and 128 to 130. A trocar and canula may also be employed for tapping the fluid.

Blood-letting.—This consists in the abstraction of blood from the system locally or generally. It is not recommended in elephants.

The objects are—

- (a) to reduce the action of the heart and so the force of the circulation ;
- (b) to reduce the quantity of blood in the system.

Blood when abstracted is taken from the vessel behind the ear or from the large vein on the inside of the thigh in cases such as apoplexy, heatstroke. The animal having been carefully fettered, the part is washed and a string is tightly tied round the limb above where it is intended to open the vessel; this raises the vein. An incision must be made through the skin and the vein opened. Elephants cannot afford to stand a large abstraction of blood; the state of the animal and condition of the pulse should denote when enough has been taken.

Failure of the heart and collapse, and anæmia from excessive loss of blood, are the more imminent dangers likely to result from injudicious blood-letting.

CHAPTER III.

STOMATITIS. DISORDERS OF THE TEETH. CONGESTION AND INFLAMMATION OF THE TEMPORAL GLANDS.

STOMATITIS OR INFLAMMATION OF THE MOUTH.

Causes.—A result of impaired nutrition due to enfeebled digestive power, local irritation, contact with acrid plants, etc.

Symptoms.—Loss of appetite which may be actual or only apparent owing to the soreness of the mouth, an investigation of which reveals in the early stages increased redness but later on actual sores. The condition is generally attended by constipation.

Treatment: Local.—If the animal will permit, wash the mouth out with permanganate of potash, 2 grains to the pint, or alum 1 drachm to the pint, or borax 10 grains to the ounce, or chlorate of potash 10 grains to the ounce; failing this the same remedies reduced to half the above strength must be brought into contact with the inflamed surfaces through the drinking water. The addition of a little sugar may entice the animal to take it. Borax and chlorate of potash in equal parts mixed with sugar or honey is perhaps the most tasteless and may be rubbed in the mouth every hour.

General.—Plenty of fresh gruel and soft food; keep the bowels regular, and give tonics (Part III, Formulæ 39 to 46).

DISORDERS AND IRREGULARITIES OF THE TEETH.

Causes.—A frequent cause of trouble is the formation of tumours which are simply due to an abnormal and excessive development of parts of the teeth. They may assume considerable dimensions. Owing to their interference with the process of mastication, great loss of condition may ensue. It is one of the causes of indigestion, colic and debility.

Symptoms.—Difficulty in mastication; very often half masticated food is dropped from the mouth; general unthriftiness.

Treatment.—The only method of any avail is removal by operation. The animal to be operated on must be made to assume the recumbent position, be properly secured; a gag having been applied, the mouth should be carefully inspected. The growths may be

removed with a fret or other fine saw ; the working of the saw is greatly facilitated by dripping water on it from a sponge or cloth. Small growths may be removed with a cold chisel. The diet of course should be as soft and nutritious as is procurable.

Occasionally a tooth may be displaced from its normal position owing to the presence of some morbid growth about the root or fang, and thus interfere with mastication by its irregularity, or from the animal lacerating the mucous membrane during mastication ; loss of condition follows. The offending portion when possible should be removed with a saw.

Owing to the peculiar manner in which the teeth are replaced, the front ones loosen and are shed. This is termed *koochlie* by the Indian mahouts. It is a natural process.

Carious teeth.—Caries of the fang of a tooth does occasionally occur. In the case of a wild elephant I shot, observing a tumour on the lower jaw, I examined it and found that it proceeded from the fang of a molar tooth which was in a very diseased condition. This elephant was given to roaming about alone and was not in very good condition. The tusk on the same side was also extensively diseased.

While on the subject of teeth it will be convenient to consider the tusks.

It is sometimes necessary to cut off a portion of one or both of the tusks ; for instance when they are badly split, or cross one another. The operation is simple an ordinary saw being used ; the saw is kept constantly wet with a stream of water. Hawkes gives the following directions for finding the proper place to cut the tusks :—“ Measure with a bit of twine the distance from the eye to the insertion of the tusk in the lip : this length measured from the latter point along the tusk will give the spot where it should be cut. Sometimes, however, especially in young animals, this site is too near the root, as the pulp of the tusk may reach beyond the point thus fixed, in which case it bleeds after the operation and frequently causes the tusk to split and decay.” The advice given by Colonel Hawkes is very sound ; the tendency with Indian mahouts is to suggest cutting off the tusk a bit too close. Care should therefore be taken to cut off too little rather than too much. Should the whole tusk split up to the root as sometimes happens, the Indian mahouts recommend that it should be completely cut off at the point where it touches the gum and this has been done with great relief to the animal.—(*Hawkes.*)

If a tusk shows any tendency to split, it should be capped with brass or iron, or an iron band applied ; this can be put on hot and shrunk on as a tyre is applied, but of course the temperature should

be much lower. A better method is to fit it with a ring which is forcibly driven on to the tusk till it maintains a secure hold.

Tusks that have been shortened often show a tendency to split.

In the female and so-called tuskless males, the tusks are liable to be broken off or to become diseased.

Should there be a cavity, it must be cleaned and washed out with permanganate of potash 2 or 3 grains to the pint and then dried after which it should be plugged with a single piece of tow or cotton wool, medicated with a few drops of carbolic acid, creosote, or oil of cloves.

If it should happen that too much of the tusk has been cut off and the pulp exposed, the following treatment should be adopted :— The bleeding is not as a rule very excessive ; the injured part must be washed or syringed out with a warm solution of permanganate of potash 2 grains to the ounce, or carbolic lotion 1 to 60, or thymol 10 grains to the pint of hot water, after which the part may be dressed with carbolic oil, iodoform ointment, camphorated oil, etc. (Part III, Formulæ 121, 122, 128, 129), and then carefully bandaged. Hawkes employed an ointment which can be strongly recommended ; it is as follows :—

Dikamali	...	...	5 tolas, <i>i.e.</i> , 2 ozs. approximate.
Bees-wax	...	...	5 tolas, <i>i.e.</i> , 2 ozs. approximate.
Gingili oil	...	...	6 tolas, <i>i.e.</i> , 2½ ozs.
Gall-nuts (powdered)	...	...	2 tolas, <i>i.e.</i> , 7 drs.

Boil the gall-nuts in the oil and add the *dikamali* ; when this has melted strain through a cloth ; lastly add the wax and stir till cold. [*Dikamali* is the Madras term for the resin from the *Gardenia lucida*, a most useful ingredient in ointments, as it is healing and at the same time repels flies.] Hawkes recommends that the ointment be rubbed over the end of the tusk and then covered over with a cotton rag ; over this a second piece of rag saturated in coal tar, or *neem* oil, *i.e.*, margosa-oil (*Azadirachta Indica*, ॐॐॐॐॐॐ), may be bound. Dress every second day.

Great care should be taken to see that flies are kept off, otherwise the wretched animal owing to the presence of maggots may have to endure fearful suffering.

CONGESTION OF THE TEMPORAL GLANDS OR “ MUSTH.”

Male elephants and very rarely females, on attaining maturity, are subject to peculiar periodical paroxysms of excitement, which seem to have some connection with the sexual functions to which the name *musth* is applied by the natives of India and *mon-kyathi*

(ရန်ကျသင့်) by the Burmans. It is probably analogous to the *rut* in deer.

Causes.—It occurs both in wild and tame animals, and in the latter is more often met with in highly fed pampered beasts that receive insufficient exercise. It occurs most frequently in the cold season and may perhaps be due to ungratified sexual desire in some cases, but not always so, since the society of a female by no means always quells or even pacifies animals in *musth*. At other times an animal in *musth* undoubtedly seeks a mate of the opposite sex.

Symptoms.—*Musth* occurs frequently in some beasts, seldom in others, so that the intervals are variable in different animals and in the same manner so are the symptoms. More or less excitement is usual, but on the other hand some elephants become dull and morose. The behaviour changes, shown by disobedience to commands, trying to break away, or showing violence to man or destructive tendencies and being altogether out of sorts. The temples become puffy, due to swelling of the temporal glands which lie beneath the skin and at this stage is called by many mahouts *kherr musth*; later an oily discharge exudes from the hole or duct over the gland which is then called *musth* by the natives. When *musth* is established there is often a partial retention of urine, the water dribbling away. As soon, however, as the urine is passed freely the natives consider the dangerous stage over, irrespective of the amount of discharge from the glands.

The attack may last a few days, weeks, or months. In some cases cowardly mahouts are said at a certain stage of the attack to administer some species of pumpkin which has the effect of abating the excitement, etc. The effect of such treatment, however, is said to be very prejudicial to the health of the animal. Mr. Petley informs me that once *musth* is established it ought to come on every year although in no particular month, and he has known elephants in which owing to overwork or ill-health the usual occurrence of *musth* has failed, to become useless for work. The only remedy is to set them free for months until *musth* again comes on, after which care should be taken to see such animals are treated with extra care.

Treatment.—On the first signs being evinced, the animal should be speedily removed from the vicinity of habitations and very securely fettered (extra chains being employed). Should he escape or show violence before being fettered, if possible give a dose of opium or ganja mixed up with plantains, jaggery, or sweetened rice. It is as well to bring in the aid of a couple of heavy tuskers if very troublesome to assist in effecting one's object. Once fettered, a female should be tethered not far from him, but should this enrage

him she must be removed. Foresters generally have some females loose with males when out grazing as a precaution, lest an animal becoming *musth* should stray away in search of such companionship and be lost as they occasionally are.

Grain must be entirely withheld and green food only given in small quantities for several days. To calm the excitement, drugs are generally necessary and the best of these in the early stage is a strong purgative (Formulæ 29 to 38), also in the early stages opium, or ganja 4 to 6 drachms, given mixed with boiled rice, plantains, or jaggery.

The following may be tried :—

Extract of belladonna two drachms, bromide of potash half an ounce, mixed with sugar and aniseed or cardamoms and given in tamarind pulp or jaggery twice a day for two days.

OR

Camphor	...	...	3 drs.
Opium	...	...	3 drs.

Twice a day for two days.

OR

Wheat flour	...	...	8 lbs.
Onions	...	...	8 lbs.
Sugar	...	...	8 lbs.
Ghee	...	...	4 lbs.

Mix and make into pills the size of an orange, and give one night and morning till the whole is taken.—*Hawkes*.

The use of bromide of potash in doses from $\frac{1}{2}$ to $\frac{3}{4}$ of an ounce once or twice daily. If this drug is given in the early stages so much the better. I have records of most troublesome animals that had always to be securely fettered during *musth* under this treatment carry on their work as usual. With drugs of the nerve-depressing class, however, exceptions must be looked for as some individuals possess greater resistance.

INFLAMMATION OF THE TEMPORAL GLANDS.

Causes.—Sometimes the unusual congestion of these glands during the period of *musth* runs on to inflammation especially when *musth* has been prolonged.

This may even go on to the formation of a fistula, in time extending to a depth of several inches, ten or more, and affecting the adjacent bone. In these cases there is often much swelling owing to pent-up matter, etc. If a probe be passed down the sinus very foul-smelling pus as a rule wells out.

Symptoms.—The temples become hot, tender, painful and much swollen and an abscess may form.

Treatment.—At first a smart purge and hot fomentations ; later, if matter forms, it should be evacuated by incision. The skin below must be smeared with oil or vaseline to prevent the discharges irritating the skin and making it sore.

Should there be a fistula with careful treatment and perseverance the cavity will heal up in due course. The best way to treat these cases is to procure rubber tubing fairly stiff, of sufficient size and length to pass down the wound and thus permit of free irrigation with a disinfecting astringent lotion. These should be freely applied at least three or four times a day and the outward opening of the sinus not allowed to close up too soon. The injections should be made lukewarm. Elephants as a rule do not object to this treatment as it seems to afford them great relief. Phenyle lotion, carbolic lotion, corrosive sublimate lotion may be used and later sulphate of zinc lotion.

CHAPTER IV.

WOUNDS. ABSCESS. SEROUS ABSCESS.

WOUNDS.

Definition.—A wound is a solution of continuity of soft structures, generally induced by violence from without, but at times from within, as is the case when a broken bone pierces the tissues.

Causes.—In elephants, fighting is one of the chief causes of serious wounds. Severe falls and other accidents may similarly occasion them.

Varieties of wounds.—For convenience of description, they have been divided into several classes. It is however only necessary to describe those most likely to be met with, namely—

- (1) *Incised wounds*, such as are inflicted with clean cutting instruments, knife (*da*), bamboo, etc. These wounds bleed freely from their whole surface and generally heal rapidly.
- (2) *Punctured*, in which the depth is much greater than its superficial extent. *Example*: stabs, wounds from spikes, bamboos and injuries by sharp tusks. These wounds are generally dangerous owing to the possibility of important organs being injured and the difficulty in thoroughly cleansing them. Any poison which may have gained entry lurks in the wound and may set up various serious diseases.
- (3) *Lacerated wounds*, in which the tissues are torn; they do not bleed so freely as incised and punctured wounds, for the simple reason that the coats of torn vessels contract more readily than is the case when they are cut clean across.
- (4) *Contused-lacerated*, in which, in addition to a wound, there is much bruising of the surrounding parts. Such injuries do not heal very rapidly owing to the mechanical injury the tissues may have suffered which may be so severe as to lead to their death.—(*Slough.*) There is a tendency to formation of matter. *Example*: After a fight, as the defeated animal retires he is often followed up by his opponent who freely butts his hinder part;

should he happen to be in possession of blunt, short tusks, a contused-lacerated wound is likely to be the result.

- (5) *Poisoned wounds*, bites of venomous snakes, stings of insects.

Treatment of wounds in general:—

- (a) Arrest the bleeding.
- (b) Search for and remove foreign bodies such as pieces of glass, thorns, splinters, and cleanse wound.
- (c) If possible secure edges of wound in apposition.
- (d) Apply dressings with a view to exclusion of micro-organisms, flies, dust, also to ensure cleanliness and promote healing.

(a) *Arrest of bleeding*.—Bleeding may arise from an artery, a vein, or capillaries. The methods employed are—

Torsion: seize the end of the vessel when seen with forceps, twist three or four times and let go; only applied to small vessels about the calibre of a packing needle or less.

Pressure, as with pad and firm bandage; only employed for slowly oozing blood.

Application of cold, such as ice; only applied for trifling oozing.

Application of heat, such as hot iron, or water at a temperature which the hand will barely bear, about 110° F.

Drugs: perchloride of iron, gallic and tannic acids.

Ligature, tying the vessel. The end of the vessel is seized with forceps and a piece of silk, catgut, or fishing gut (previously disinfected) tied round it and secured. The thread is then cut off leaving ends from $\frac{1}{2}$ to $\frac{3}{4}$ of an inch in length. If the vessel be a vein both ends must be secured. This is the method most certain and can be applied to vessels of any size.

Blood from an artery may be recognized by its red colour, rapid flow and the blood spurting out in jets; while that from a vein is darker and the flow continuous. In capillary bleeding there is a general oozing over the wounded surface. Capillary bleeding is the least serious.

The danger of bleeding depends on the size of the vessels injured; if large and not secured the animal will bleed to death. Bleeding from large arteries and veins is serious. Hæmorrhage from small arteries, small and even medium sized veins, frequently stops without interference of any kind. Hæmorrhage is more severe when a

vessel is divided transversely than when the wound is in a longitudinal direction and the more rapid the loss the greater the danger.

Symptoms of severe bleeding are a blanched state of the membranes, coldness of the body and extremities, a swaying staggering gait, marked weakness and prostration. If the pulse can be taken it will be found to be irregular. The animal falls, usually becomes unconscious, the excretions may be passed involuntarily, a few slight convulsions and the animal is dead.

(b) *Removal of foreign bodies.*—Splinters of wood, pieces of glass or bone and other bodies often remain in a wound; search should always be made for these and if found removal may be effected by means of the fingers, or with the aid of forceps. Much handling and probing of a wound is not necessary. Dirt, gravel, can best be removed by the free use of warm water. As a rule no raw surface should be wiped or rubbed. To cleanse the wound, small pieces of clean old linen should be employed. This may be carried out by merely dipping clean cloths in boiled water (which should be lukewarm when used) or in a weak solution of carbolic acid (1 to 60), phenyle (1 to 60), or 2 to 4 grains of permanganate of potash to the pint (Formulæ 114 to 120). Each cloth should be gently squeezed above the wound so as to allow the water to trickle over it, or better still, rubber tubing may be attached to a funnel, or a large tin-pot with a spout. The solution can then be directed all over the wounded surface so as to thoroughly cleanse it. A large syringe also answers the purpose. Great force is unnecessary.

As a precaution, when an elephant will permit the operation, in cases where punctured wounds are found on the limbs, after the offending agent is withdrawn, the wound should be enlarged with the knife, carefully inspected again for foreign bodies and then treated with carbolic acid (1 in 3), which must be carefully rubbed into the deepest portions, but this method must not be applied wherever there is any likelihood of any internal organ being touched; here it is best to cleanse the wound with carbolic lotion (1 in 40) and dress and await developments.

Generally speaking the less wounds are handled and interfered with the quicker they heal. Mahouts are fond of treasuring up every piece of filthy rag for future use and they are for ever rubbing or wiping raw surfaces with them, and not infrequently use them for plugging wounds of the back. There is only one way of preventing this, namely to *make a point of burning all pieces of cloth and dressings after use*; and this is not much trouble.

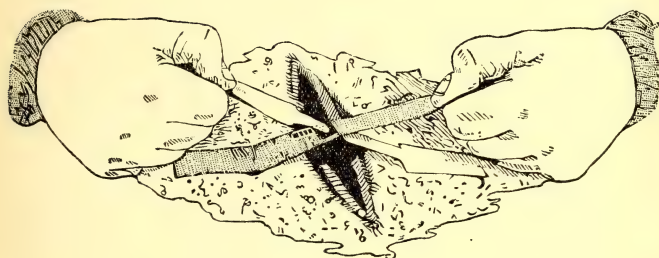
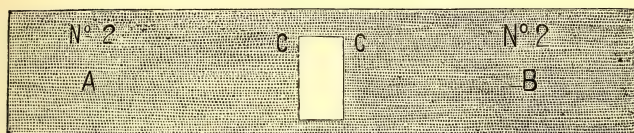
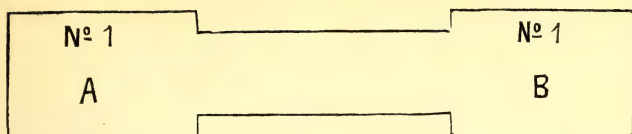
(c) Whenever a wound is found gaping, it is where possible desirable to bring the edges into contact in order to promote union, and the handiest method and one least calculated to be

resented by the patient is to apply strips of the best resin plaster ; each strip must be passed sharply backwards and forwards over hot embers to ensure perfect adhesion. Hair should be removed.

To apply it cut two strips of plaster about 2 feet in length and of width according to length of wound, say from 1 inch to 3 inches, shaped as Nos. 1 and 2 ; pass No. 1 through the window C of No. 2 and adjust before sticking down, so that the length of one piece overlies the length of the other (*see* Fig. 36). Having done this, stick A end of No. 1 on one side of the wound and the B end of No. 2 on the other, leaving the B end of No. 1 and the A end of No. 2 free. Exert traction on both these free ends, which will approximate the edges of the wound. Having performed this stick the ends down. In case the above is not clearly expressed, cut strips out of paper and practise the method. This plan answers well in some wounds.

Another method may be tried as follows : Suturing or sewing. This is a less easy matter in the case of elephants owing to the thickness of the hide and the strength of the muscle beneath the skin. It is certainly worth trying in recent incised wounds. Ordinary stitches do not as a rule hold well. The use of some new suture buttons suggested by Mr. Pugh, and manufactured by Messrs. Arnold & Sons, West Smithfield, London, is therefore recommended. The button is to be had in various sizes and in two shapes, oval and round. It is made of aluminium and is therefore light ; there is a hole in the centre for passage of the wire and on each side of the hole is a clip, around which the wire can be twisted in a figure of eight. The advantages claimed are : its simplicity and lightness, it prevents cutting or tearing of the edges of the wound, and lastly it is easily rendered aseptic for future use by boiling.

In stitching elephant wounds separate stitches are the best. It is better to make the first stitch at the centre of the wound. To make a stitch, the needle is passed through the skin on one side of the wound from without inwards ; then through the other edge from within outwards ; the ends of the wire are to be taken and drawn in gently so as to bring the edges of the wound together ; when this has been effected, the ends of the wire are to be twisted securely. The employment of buttons will be preferable. Stitches should not be too close : a space of at least $1\frac{1}{4}$ inches to $1\frac{1}{2}$ inches should be allowed. The most dependent part of the wound must be left open in order to permit free escape of all discharges. The lips of large gaping wounds must not be forcibly dragged together, as the stitches will cause much pain and are almost certain to give way. Again, stitches should not be made too near the edges ; they should



Method of applying to wound.



A and B in position over the wound.

FIG. 36.

be placed far enough from them and of sufficient depth to ensure a good hold.

(d) *Dress the wound*.—Dressings should be applied where an animal can be kept quiet and prevented from removing them. The object of dressing is to keep the wound clean, to prevent exposure to the air, entrance of dust, micro-organisms, flies and to provide a means of applying certain medicaments (*see* Formulæ 121, 125 to 129 and 64 to 69).

In any wound where much pain is evinced the following may be employed to allay this:—

Acetate of lead	...	4 grs.
Acetate of morphia	...	2 grs.
Water	...	2 ozs.

In a neglected sore there may be maggots which may be actually seen, or suspected by applying the nose close to the wound, when there is usually a fœtid odour and a dirty offensive thin discharge. When seen they must be removed with forceps; if only a small opening exists, it should be opened up and the maggots cleared out, and subsequently the wound dressed with carbolic acid lotion (1 in 40). Some elephants will not permit much handling, others insist on removing dressings, blowing in dirt, etc.; and when wounds exist in such animals, to avoid the entrance of flies, *dikamali* ointment (the resin from the *Gardenia lucida*), a common bazaar drug (Formula 130), or powdered camphor dissolved in spirit and mixed with sweet-oil, or equal parts of turpentine and sweet-oil, should be very frequently applied. The above-named drugs will also remove maggots from wounds.

Poisoned wounds.—These include snake-bite, stings of insects, and wounds inflicted by tigers.

In the case of hornet stings, apply dilute ammonia.

Snake-bite.—I have heard of three cases of elephants said to have been bitten by cobras; no case proved fatal, though one was reported to have been in a precarious condition for twenty-four hours.

When elephants die suddenly Burman mahouts invariably report the cause of death as due to snake-bite. I think I am correct in stating that quite a large number of deaths amongst elephants in this Province are attributed to snake-bite. I have never seen a case proved nor have I met anyone who has. Owners should not accept such reports unless there is ample proof. The poisonous snakes likely to be met with in heavy jungle are—

- (1) Hamadryad (ငန့်၊ ငန့်ခိုဝ်), rare.
- (2) Cobra (ငြိငြိဝိုဝ်), rare.
- (3) Green pit viper (ငြိဝိုဝ်), a common tree viper the bite of which however is very rarely fatal even to human beings.

In open country—

- (4) Russell's viper (မြေငွေ့), common.
- (5) Cobra (မြေတောင်), common.
- (6) Banded krait (ခန်းဆင်ကြာ), common.
- (7) Indian krait, rare.

In cases of suspected snake-bite the Burmans apply what they consider an infallible method of diagnosis which is that in every case of snake-bite the hair from any part of the body can be pulled out without any effort.

Tiger-wounds.—Elephants are occasionally attacked and severely mauled and the wounds inflicted are peculiarly poisonous, but such wounds must be treated on principles already laid down, that is thorough cleansing and application of some caustic such as carbolic acid 1 in 3.

Healing of wounds.—Wounds are said to heal by primary union or first intention, or by second intention, and thirdly under a scab.

Healing by the first method is rare and can only be brought about in clean-cut wounds whose edges can be brought together by stitches and protected by careful dressing, *e.g.*, surgical wounds. The edges of the wound adhere very quickly and become covered with a thin scab of clotted blood. This scab soon falls off, leaving a slight scar which soon loses its colour.

Healing by second intention or granulation with or without suppuration is the commonest method. When not disturbed the wound is soon covered with blood and lymph which quickly dries, and later on a thin secretion is poured out which gradually becomes thicker and of a yellow colour. In a few days granulations (small red points) form, which rapidly increase filling up the wound. The secretion gradually lessens and it will be noticed that the skin around the edges begins to contract, the granulations also shrink, gradually drawing together the edges of the wound and this results in the formation of a white depressed linear scar. Healing under a scab occurs in small wounds which are not exposed to infection such as abrasions or excoriations. It may also occur in small incised or superficial wounds which have been almost immediately covered with antiseptic powders such as boric acid, etc. The dried blood, etc., soon forms a scab under which the injury heals by granulation. The scab after a time drops off and leaves exposed a soft red cicatrix or scar which afterwards becomes pale and hard like the surrounding tissues.

When dressing wounds the soiled dressings when adherent should be thoroughly soaked with solution of carbolic acid or phenyle (1 in 60), and gently withdrawn instead of being pulled off.

Apart from damaging granulations, the more pain occasioned the more timidity will be aroused in the patient and greater will be the difficulty in future applications.

Owing to the neglect and improper treatment of wounds, elephants are constantly incapacitated for work for months, which is absurd. Experience proves that with care and attention wounds in elephants, though perhaps not disposed to heal as rapidly as in most other creatures, will heal in about one-fourth the time it takes a mahout to cure them.

Owners of elephants and especially firms who have European assistants should insist that elephants placed in their charge *shall not be treated* (except under their personal direction) *by mahouts*.

The assistants should be careful to note that the strength of all antiseptics, disinfectants, etc., laid down should be adhered to. In many cases much unnecessary pain and injury to the tissues is caused by using these solutions much too strong. The method of pouring an unknown quantity of drugs such as phenyle and carbolic acid, etc., into a bucket of water is to be strongly condemned.

ABSCESS.

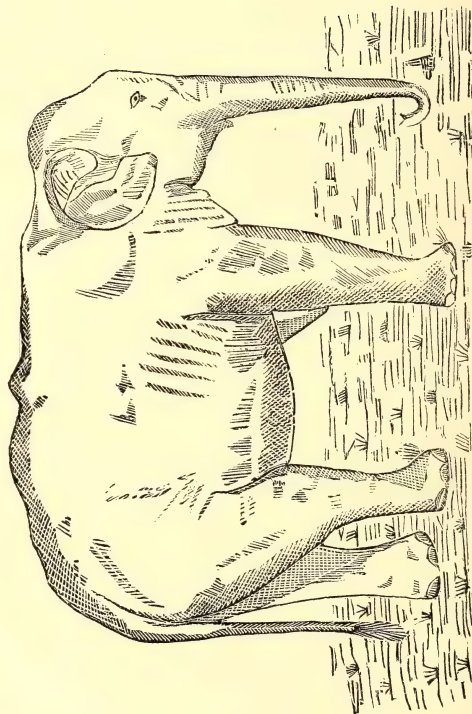
The term applied to a circumscribed collection of matter (pus) usually occurring in the deeper layers of the skin or tissues beneath it.

Causes.—Entrance of micro-organisms, irritation and uncleanness, pricks from thorns, stakes, nails, bruises, uneven pressure from loads, ill-fitting gear; hence it follows that they are most often met with on parts subject to pressure such as the back and sides; they are not infrequently seen in the feet.

Symptoms.—Swelling accompanied by heat (not always pronounced), pain and tenderness. The formation of matter in these animals is a somewhat slower process than in man and many animals and, owing to the thickness of the skin, the abscess does not readily come to a head and so permit of exit of the contents but instead it burrows beneath it. Constitutional disturbance is manifested by a more or less severe degree of fever.

Treatment.—As soon as a swelling about the back after work is noticed, it should be treated as laid down later for this condition under the heading of abrasion. When matter has formed, the only treatment consists in evacuating it; this in itself is a simple process, but the diagnosis of the presence of fluid is frequently a difficult matter as, owing to the thickness of the skin, fluctuation is not readily obtained. To observe fluctuation, place the fingers

CASE OF LOSS OF SOME OF THE SPINAL PROCESSES FROM SOREBACK
(AFTER SANDERSON).



firmly on one side of the swelling and with the fingers of the other hand gently press the tumour ; if the swelling be felt to rise and fall under the first hand, it is due to the presence of fluid, and the sensation imparted is what is understood as *fluctuation* ; it is as well to try and obtain it in two directions at least. To recognize fluctuation only requires a little practice, but much skill is necessary to detect matter in small quantity or where it is deeply seated. As already observed if matter be not liberated it will burrow and increase the extent of the mischief ; hence it is essential to evacuate it as soon as possible after it has formed. A swelling that has shown no sign of reducing and is attended by pain, local heat and tenderness, and especially if there be any fever present, even if fluctuation be not obtained, a knife should be plunged deeply into it, for it is better to do this when no matter exists than to postpone doing it for some time after it may have accumulated ; no harm beyond laying the animal up for a few days can arise from the first contingency, but considerable harm in the latter.

A better method, whenever there are any reasonable grounds for suspecting the presence of matter, such as continued high temperature after an injury, is to use a fine trocar and canula (Campbell's) and plunge this into the suspected swelling and on the removal of the trocar fluid if present will flow through the canula and the swelling may then be freely opened with a knife. Two or three punctures may be made in different parts. No harm is likely to result from this procedure provided the instrument is well boiled before use ; on the contrary some swellings where pus has not been detected have dispersed after puncture.

Mahouts are proverbially dilatory in opening an abscess and prefer to leave it, saying that it is not ripe or too hard and are therefore responsible for the loss of an animal's service for a much longer period than need be.

Method of procedure in opening an abscess.—First of all wash the part thoroughly with some disinfecting solution (*see* Formulæ 114 to 120), then plunge a knife deeply into the most prominent part of the swelling, *i.e.*, stab it, or better still, first plunge a fine trocar and canula into it, withdrawing the former ; if matter now escapes, make a free incision into the swelling in such a situation as to allow the readiest means of drainage, that is if on the back incise the lowest portion of the swelling. Naturally, if the upper portion were opened a pocket would be left in which the discharges would collect. A free incision right through the length of the swelling is the shortest procedure in the long run. Mahouts if allowed to carry out their own methods will tinker about the business, fail to give free vent to the discharges and will lay an animal up indefinitely. If in the

region of the spine or bony points, the hands or fingers should after disinfection be thrust in and the wound explored for dead pieces of bone, which may occasionally be found and should be removed, after which the cavity should be cleansed by syringing it out with disinfecting lotions and the wound dressed, and a large piece of lint steeped in some camphorated oil, *dikamali* ointment or some other preparation which will keep flies away (*see* Part III, Formulæ 128, 130 and 137) should be placed between the lips of the wound to prevent its closing too rapidly. Dressings can be kept in place by using strips of good resin plaster. The cavity will require dressing at least once daily till healed. In neglected cases when the skin has become undermined, and this may be extensive in every direction, to promote the healing process it is necessary to have recourse to caustic solutions. The cavities should be syringed out with tincture of iodine, 1 to 2 drs. to the pint, carbolic acid (1 to 20), or sulphate of zinc or copper lotion, 5 grs. to the ounce (also *see* Part III, Formulæ 98 to 102), after which as a rule healing commences; if not, the injection must be repeated every second or third day till the wound assumes a healthy aspect. Where pockets exist, one or more openings should be made so that the discharges can completely drain away. Pieces of tape previously disinfected may be passed from the original wound through the new openings and then knotted, or a piece of wood tied at each of the ends to keep them from slipping through; the tapes should be moved up and down once or twice a day and removed as soon as a healthy discharge issues (*see* Setons, page 113). In old standing cases a blister or strong liniment applied over the undermined portion but not on the wound itself often promotes healing. *All incisions through the skin should as much as possible be made in the direction of the natural folds or wrinkles, not across them*, otherwise they will gape and when healed leave ugly scars (*see* Fig. 36).

SEROUS ABSCESS.

What are known as serous abscesses are occasionally met with, they may contain blood or serum.

Causes.—Falls or severe blows.

Symptoms.—After a heavy fall or a severe blow, a swelling suddenly appears, fluctuation may be detected, there may be no heat or pain as in an acute abscess containing matter, the effused material may be blood or serum the result of direct injury to the underlying tissues, or rupture of some of the vessels.

Treatment.—Rest, a purgative and frequent fomentation, which usually brings about absorption of the effused material. Should the swelling increase and be accompanied by doughiness, increased pain, heat, tenderness and fever, it may be inferred that matter has formed (purulent abscess), and must accordingly be evacuated without delay and treated as laid down.

NOTE.—*In operations such as opening abscesses and cysts, slitting up sinuses, removing small tumours, etc., gratifying results are obtained by the injection of "Eudrenine" into the surrounding tissues. This preparation is a combination of Eucaïne and Adrenalin whereby the properties of the two drugs are combined, the former renders the part painless while the latter prevents bleeding. It is employed by injecting deeply 15 to 20 minims with a hypodermic syringe at various points around and into the part to be operated on and waiting 10 to 15 minutes to allow it to take effect. Three-quarters of an ounce may be injected. Messrs. Parke Davis & Co., who have Agents in Bombay and Simla, supply Tabloids, etc., with full directions for use.*

The preparation might be made up of the strength recommended by Wallis Hoare, viz. :—*

Eucaïne Hydrochloride	...	...	$\frac{1}{6}$	gr.
Adrenalin Chloride	...	...	$\frac{1}{2000}$	gr.

in each cubic centimetre (about 17 minims).

* "Veterinary Therapeutics and Pharmacology," by Wallis Hoare, F.R.C.V.S.

CHAPTER V.

ULCERATION. SINUSES AND FISTULÆ. BURNS AND SCALDS.

An ulcer is an open sore of some superficial structure, whether skin or mucous membrane.

Causes.—Ordinary pus forming organisms of specific disease, neglect of abrasions or wounds, malnutrition.

An ulcer is brought about in the same manner as an abscess, with this difference, that in an abscess the dead material is retained in the tissues, whereas in an ulcer dead cells are thrown off almost immediately. In the case of a wound which degenerates into an ulcer, it should be remembered that the natural tendency of all tissues is to heal, but neglect or severe injury to the tissues so lessens their vitality as to allow pus-forming organisms to gain the upper hand, with the result that the wound instead of healing becomes an ulcer and tends to enlarge.

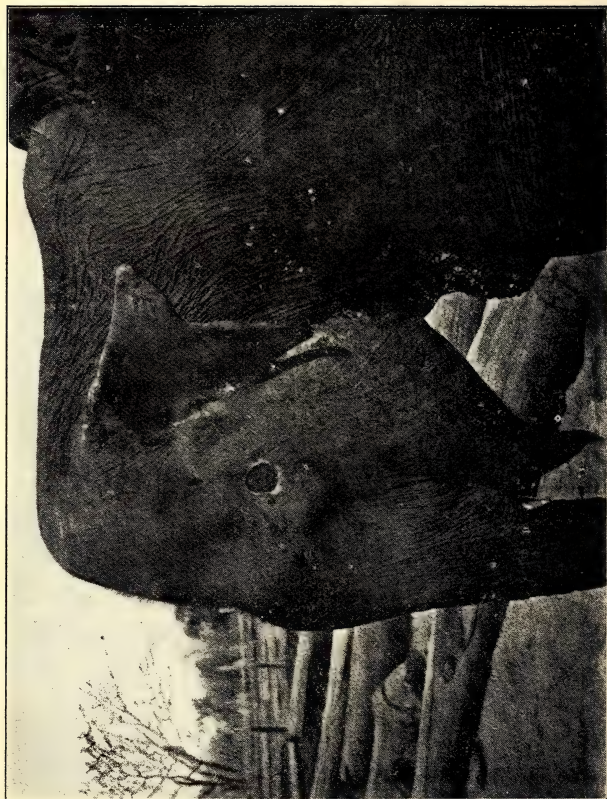
Characters of an ulcer.—Ulcers may be classified into three main groups—

1. Ulcers which are granulating.
 2. Ulcers which are spreading.
 3. Ulcers which are stationary.
1. Ulcers which are granulating may be quite healthy, in which case we find the base of the ulcer covered with an even layer of small red uniform granulations with sharp points which do not bleed readily if lightly touched, the edges neither everted nor inverted and with a glistening mother-of-pearl-like appearance, showing that it is commencing to heal over. The discharge is small in amount, yellowish in colour, contains little pus and is inodorous.

Treatment.—Consists chiefly in cleansing the sore by irrigation with some such lotion as carbolic acid, phenyle (1—80), perchloride of mercury (1—2000, *i.e.*, grs. v to the pint), potassium permanganate (grs. iv—xx to one pint), thymol (grs. x to one pint). It may then be dusted with boracic acid powder, equal parts of iodoform, zinc oxide and starch, or equal parts of iodoform and starch (*see* Part III, Formulæ 64 to 69).

A granulating ulcer is said to be weak when its base is covered with an uneven layer of granulations which are irregular in shape, flabby and with more or less rounded points and discharging a thin unhealthy-looking pus.

PLATE IX.



COW ELEPHANT "MA PO."

Showing loss of cartilage of ear, the result of extensive ulceration; also showing original ulcer nearly healed.

Treatment.—The ulcer should be washed as before and lead lotion (*see* Formulæ 105 and 106) should be applied, or a lotion consisting of zinc sulphate and lead acetate, two drachms of each to one pint of water. Sulphate of copper or sulphate of zinc lotion (grs. ii to the ounce) may also be used (*see* also Formulæ 61 and 62). As dry dressings, equal parts of alum and starch or acetate of lead and starch may be used. Sometimes a gentle scraping of the base and edges of the ulcer with a blunt knife will excite healthy granulation.

Again, the base of a granulating ulcer may be covered with large prominent dark red uneven granulations which easily bleed, the edge may be concealed by the sprouting base, the surrounding tissues are healthy looking, and there is abundant discharge of matter; such an ulcer is known as an exuberant ulcer.

Treatment.—The ulcer should be thoroughly washed as before, and should then be touched once daily or every other day as necessary with Sir W. Burnett's fluid * (zinc chloride lotion) of a strength of half a drachm to eight ounces of water. Sulphate of copper or sulphate of zinc (grs. x to the ounce) may however be used instead until it assumes a healthy appearance, after which it may be dressed with ordinary dressings. If the discharge is excessive the dry dressings should be changed frequently. With these ulcers pressure, *i.e.*, the application of a pad of medicated tow or cotton wool with a bandage if it can be applied, often yields good results; care must, however, be taken that the bandage is not put on too tight.

2. Ulcers of the spreading variety are characterised by the base being depressed, or uneven in appearance and reddish yellow in colour. The edge may be uneven but sharply defined and the surrounding skin is red, inflamed hot and painful, the discharge is thick and greyish yellow in colour and the ulcer shows no tendency to heal.

These ulcers, though not common, are occasionally met with; I quote as an illustration a case sent me by Mr. Nisbet of Messrs. Steel Brothers & Company (*see* Plate IX).

A female elephant "Ma Pu":—

"The left side of the head is all diseased, the ear being three-quarters eaten away. During the last day or two it has reached the right side of the face, having travelled round the chin which is also diseased. To outward appearance the skin of the part affected is dry and cracked, and here and there the skin is off altogether, the part is also all swollen. The disease is of long standing."

* Sir W. Burnett's disinfecting and antiseptic fluid contains 25 grs. of zinc chloride in every fluid drachm. It is a strong caustic and should be employed with great care.

A Burman who informs me he has seen two or three cases of this with elephants before says the disease slowly eats into the brain through the ear hole or the throat, when the animal dies, and there is no cure for it.

As a matter of fact these cases after proper treatment usually do quite well.

Treatment.—This variety of ulcer is extremely troublesome besides being extremely painful. The treatment consists in the relief of pain by the application of powdered opium $\frac{1}{2}$ to 1 dr. in hot water, 8 ozs. macerated for two hours and then decanted, or acetate of lead 8 grs., acetate of morphia 8 grs., water 4 ozs. Sir W. Burnett's fluid of a strength of 1 dr. to 16 ozs. of water, or nitric acid lotion may also be used, consisting of $2\frac{1}{2}$ drs. of dilute nitric acid to 8 ozs. of water. Sulphate of copper 16 grs. to water 8 ozs. may also be used mixed with equal parts of the abovementioned opium lotion.

Sometimes the base of the edge of the ulcer is covered with a tough tenacious material, the surrounding tissues are swollen and painful, and the discharge is extremely offensive.* Such a variety is known as sloughing ulcer.

Treatment.—The application of warm opium lotions made as already mentioned will be found of benefit. Creosote ointment (oil of creosote 20 drops to lard 1 oz.), carbolic acid ointment (grs. x—xx to boracic ointment 1 oz.) may also be used.

3. Ulcers which are stationary are recognised by the fact that their bases are depressed and sunken, they are devoid of granulations, and they may appear as smooth and glistening or covered with a thin tough rind; their edges are smooth, rounded, glistening and inverted, and they discharge a thin watery fluid often very foul smelling.

Treatment.—Thoroughly wash with antiseptics and apply resin ointment (see Formula 131), or nitrate of mercury ointment or Friar's balsam. Any of the lotions mentioned in Formulæ 109 to 113 may be used.

In all cases of chronic ulcerations, where the base is depressed and the edges are callous and hard, scraping with a blunt knife until they bleed freely generally yields good results. Whatever may be the nature of the local treatment decided on, it is always desirable to supplement it by internal medication in the way of tonics, the best being arsenical preparations or iron combined with cinchona, nux vomica, etc., the bowels should be kept regular, and good clean nourishing food is also necessary if good results are to be expected.

A special form of sore which is occasionally met with, as far as my experience goes, during the rainy season, is probably due to a specific organism. It is usually situated about the feet, but Messrs.

Royle and Baker of Messrs. Steel Brothers in the Katha District came across similar sores about the body, especially in the region of the saddle. Animals in good condition are attacked as well as others; the first thing observed is a swelling which may be about the size of a pigeon's egg, *i.e.*, half to an inch in diameter, more or less circular in shape, hard to the touch and not painful, in fact it resembles a chafe. If disregarded, the centre softens and breaks down and a white fibrous-looking core sloughs out, leaving a raw healthy-looking ulcer with clean cut edges.

Treatment.—If the swelling be observed early two or three paintings with double strength iodine liniment may disperse it. A hypodermic injection of a few drops of pure carbolic acid into the centre of the swelling is also of service. After the slough has come away, the surface of the wound should be well washed with disinfectants and cauterised if necessary with lunar caustic, copper sulphate, or swabbed out with Burnett's fluid $\frac{1}{2}$ dr. to 8 ozs. of water, after which it may be treated in the ordinary way. Internally calcium sulphide may be tried in 3-dr. doses.

Again in cases of advanced debility, ulcers about the genitals are often observed only visible during micturition. Their treatment is obvious, *i.e.*, tonics, rest, cleanliness, good nourishing food, and dressing with some mild ointment.

INJURIES AND ULCERS ON THE ELBOWS.

Causes.—Animals being frequently made to assume the recumbent posture on hard ground for loading, swelling may result at the points of contact with the ground; if neglected they may ulcerate causing troublesome sores. They are not frequently met with in Burma, as generally speaking most people use the *kah* or basket, and the animal is not as a rule required to assume the recumbent posture, the packages being handed up. Sanderson's pattern gear is supplied to Government officers. In an article in the "Veterinary Journal" of November 1882, Nunn treats of these sores.

Symptoms.—Local swellings in the position of capped elbow in the horse; the swellings are often very painful and tender.

Treatment.—Avoid the cause abovementioned and do not keep an animal in the recumbent position longer than is absolutely necessary. The elephant should be loaded as quickly as possible, and this can be done if those around are made to work instead of talk and argue with the mahout.

The animal should be tethered on soft ground so that he may lie down; fomentations and afterwards painting with liniment of iodine

(Formula 138), or applying a blister, may reduce the swellings. If ulcerated, treat as laid down under that heading.

ULCERATION OF THE FOREHEAD.

The skin of the forehead is liable to become tender and sore from constant exposure to a hot sun. Ill-tempered careless drivers are given to a too free use of the goad, inflicting punctured wounds. Injury may also occur to the forehead when not protected, while the animal is engaged in pushing or overthrowing obstacles.

Care must be taken with these cases, as the inflammation is liable to spread to the sinuses of the skull.

Treatment.—If due to exposure, the animal should be given complete rest, kept under shelter, the bowels opened by a smart purge, and cold applications by wet cloths applied (Formulæ 103 to 106). In some cases hot fomentations afford more relief. When the inflammation subsides, alum lotion, or weak zinc or copper lotion, 3 to 5 grs. to the ounce of water, may be applied, or carbolic, iodoform, or oxide of zinc ointment (*see* Formulæ 109, 110, 125, 127, 129).

When lotions are used, care should be taken to see that the cloths are well wrung out to prevent any dripping into the eyes, and as an extra precaution vaseline, lard, or oil should be freely smeared round the eyes.

In severe cases there may be some ulceration and formation of matter. Such parts must be kept thoroughly clean, the matter given free exit and the injuries carefully protected. Some of these cases are difficult to cure. If the ulcers are indolent, they may be touched with a little lunar caustic or blue-stone, or dressed with ointment subacetate of copper 2 drs., oil of turpentine 2 drs., lard 3 ozs. The turpentine and lard should be melted together and the copper later thoroughly stirred in. If the bone be exposed, the surface should be dressed with dilute nitric acid lotion (dilute nitric acid 2 drs. to 8 ozs. of water).

Elephants that are much exposed to the sun should be provided with a quilted pad, especially if employed for much pushing work. If a pad is not available, a coating of pipe-clay, chalk, etc., assists in protecting the head from the effects of the sun. Oil is very useful to the attendant so is indented for, but is of no material advantage to the elephant.

The skin of the forehead of elephants under Indian mahouts is often tender and sore, owing to the brutal manner in which many of these men employ the goad. The best treatment for maltreatment

and carelessness is to place the attendants on half pay during the period their charge is incapacitated from work.

ULCERATION OF THE EAR.

This may be seen on the edges of the ear, on the flaps, or in the canal which leads internally.

Causes.—Dirt, advanced debility and old age, or bathing the animal when heated, neglected tears and wounds. The condition is also met with sometimes in well-conditioned elephants, the tail being affected at the same time, and this may be due to eating certain grasses, or even grain food affected by a fungus such as "ergot." Ergot is a fungus which grows on rye and other grasses and produces gangrene, or a destructive ulceration of the fingers, toes and other extremities in human beings. It seems possible that this identical fungus or something similar may account for this condition which we see in these animals.

Symptoms.—That form, seen on the edges of the ear, has a tendency to spread and the parts to become destroyed and thrown off, considerably reducing the size of the flap.

That which is met with on the flap and sometimes extending into the canal, discharges profusely. When the canal itself is attacked there is a danger of the disease extending to the brain.

Treatment—Is difficult in this situation owing to the perpetual motion of these appendages. The sore surfaces must be kept thoroughly clean and dressed on the lines already mentioned for ulcers.

When the canal is affected, a syringe will be required to keep the parts clean; no force should be employed and the canal must not be plugged. To insure powders reaching the ulcerated surfaces, they should be placed in a small bamboo, which when inserted into the orifice may have its contents gently blown in.

ULCERATION OF THE TAIL.

Ulceration sometimes attacks the extremity of the tail.

Causes.—General debility or extreme age, though young and well-conditioned animals may suffer. A similar condition may be met with in monkeys, and I believe in the camel.

Symptoms.—The hair is shed and the skin ulcerates for a variable distance up the tail. This destructive process is prone to extend to the deeper tissues, all of which may die and considerable portions

of the tail may slough off. In some cases, in spite of active and careful treatment, the destructive process continues till it reaches some 8 or 10 inches from the root of the tail. Mr. Petley informed me that the Burmans state that if unchecked the disease spreads to the spine. The disease is known to the Burmans as *khoo-sah-de* (eaten by a caterpillar), ဝေဇ္ဇာဝေဇ္ဇာ. The elephant a *tai* in Plate X shows a bandage round stump of his tail. This animal was treated for a long time by Mr. Petley but nothing seemed to arrest the disease.

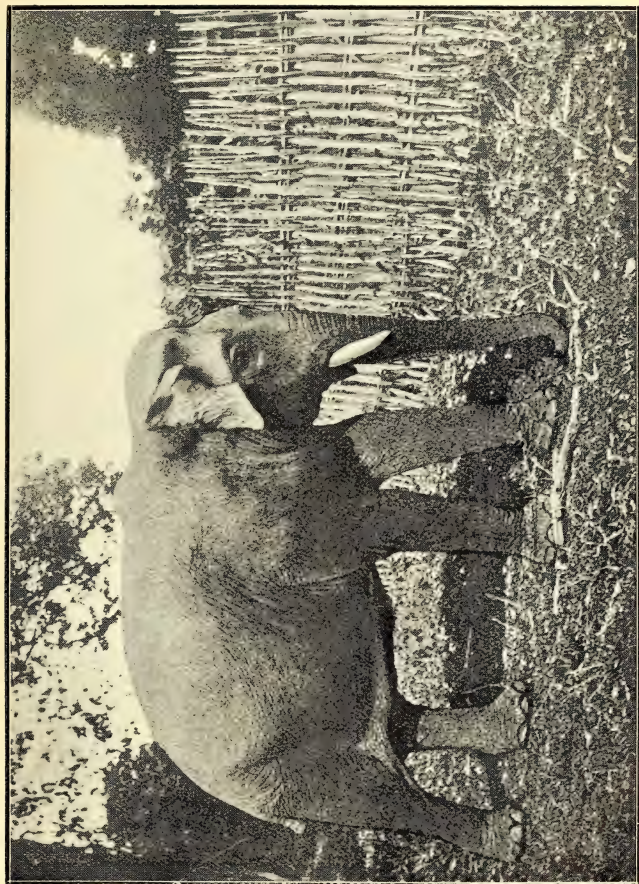
Treatment.—As laid down for ulcers in general, but Burnett's fluid and nitric acid diluted as already stated are the best to try in these cases.

SINUSES AND FISTULÆ.

A sinus or fistula is an abnormal narrow channel in the tissues forming a communication between a septic focus and some other part of the body such as the surface of the skin or a natural cavity. The term sinus is applied when the tract is open at one end and the term fistula when it is open at both ends. As a rule sinuses and fistulæ arise from an abscess which has not closed by reason of containing some dead tissue or other foreign body. The most common seats of sinuses, etc., are above the hoof-slipper, on the spine, and the temporal gland.

Treatment.—Consists in searching for and removing the cause if possible; in neglected abscesses of the spine the cause is usually found to be the presence of a portion of dead bone. In the feet the sinus will be found to communicate with a small abscess cavity; the pus not having been able to escape through the sole has followed the line of least resistance and burst above the slipper. In all cases treatment consists in rendering the parts healthy, therefore one should scrape out all dead tissue; this object may also be effected in situations where the use of a knife in inexperienced hands entails some risk by the injection of Burnett's fluid 1 dr. to 8 ozs. of water, solution of nitrate silver 10 grs. to the ounce, or a very small quantity of powdered corrosive sublimate rolled up in the form of a cigarette in cigarette paper may be rammed down and left for a couple of days, after which the dead tissue will slough out, leaving a healthy surface which may be healed by the ordinary means. In cases where the sinus communicates with an abscess cavity the best treatment consists in slitting up the sinus so as to let out the pus. Should a sinus or fistula extend into a joint cavity setting up suppuration there, the joint should be thoroughly washed

PLATE X.



FINE SPECIMEN OF A TAIL, SUFFERING FROM PROGRESSIVE ULCERATION OF THE TAIL.

out with antiseptic solution and then an injection of one part of corrosive sublimate to four parts of glycerine and an equal quantity of water should be made into the joint once. This produces great swelling and a considerable amount of pain for twenty-four hours, but at the end of that time the sinus will generally be found closed. A full dose of opium should be given before the injection, as considerable difficulty may be experienced in administering it later.

BURNS AND SCALDS.

When left to himself the elephant is not subject to this class of injury, but in captivity he may be accidentally injured. The degree of injury varies from simple scorching to complete destruction of the skin and underlying tissues of the part. When deep or extensive they may cause a fatal termination through shock or the absorption of toxic products produced by tissue destruction.

Treatment.—The first principle in the treatment of these injuries is to protect the parts from the air by the application of oily dressings such as carron oil, *i.e.*, linseed or olive oil and lime water, in equal parts and well shaken to ensure mixing, or subacetate of lead solution 2 ozs. and linseed oil or other bland oil 16 ozs., after which cotton wool and bandages should if possible be applied. Later on antiseptic dusting powders will do all that is necessary.

CHAPTER VI.

SPRAINS. FRACTURES AND DISLOCATIONS. CRAMP. RHEUMATISM.

SPRAINS.

The elephant though a sure-footed animal is liable to sprains, especially of the joints a little above the pad in the fore and middle of hind limbs. They occur when animals have to pass over rocky ground, getting a foot suddenly wedged between heavy logs, placing a foot on unsound ground (and it is surprising how frequently elephants will do this, though they are credited with being so very careful), working in heavy mud such as tidal creeks. Wild elephants do not appear to be more cautious than tame ones, as it is not unusual when following up a herd to find that a member of it has walked upon ground apparently sound, and on which one of his legs has gone through to a depth of a couple of feet or more, and I have on two or three occasions come on places where a bank has given way, and by the saplings and bushes knocked down, there was little doubt that the elephant went down also. I also witnessed an accident where a loaded elephant was walking along on a newly made road, when it suddenly gave way under him and he rolled down some 40 or 50 feet screaming and trumpeting. We had to get a couple of elephants down to assist him to rise after the load was removed. The camp was fortunately not far off, so he was walked in quietly without his load. He showed no symptoms that day beyond stiffness but next morning he could hardly move; one of his legs, near hind, was much swollen from foot upwards for about a foot, and he was very tender and sore over the loins. He made a good recovery under treatment but it took two months.

Fording streams with a rocky bottom, especially where there are a number of large loose stones, renders animals liable to sprain, as also does overloading, hurrying them especially in hilly country.

Symptoms.—Enquire into the history of the case: Lameness, heat, swelling, tenderness and pain. There is often very great pain when the joint is involved, so much so as to induce fever and loss of appetite.

Treatment.—Cold water continuously applied by standing the animal in a stream, cooling lotions may be used (*see* Formulæ 103—106). When the inflammation has subsided stimulating

liniments (Formulæ 70—74) may be rubbed in, or a smart blister applied. As a means of gentle exercise when the acute symptoms have subsided, swimming a short distance will be found suitable.

In certain sprains of the limbs elephants may be kept standing and resting the injured limb so long that the tendons may become contracted, with the result that the animal is rendered useless. Care should therefore be taken in all such cases that gentle exercise is begun as soon as the acute symptoms have subsided. Should there be a tendency this way it is necessary to make the animal extend his limb, and for this purpose a boot with a batten of wood of required size fixed on the sole should be applied. This treatment has proved beneficial in the two or three cases that I have met with.

Injury to the loins.—In these cases the injury usually takes place when a loaded animal is going down a very steep place; his fore-legs may suddenly slip ahead, and to stop himself he drops his hind-legs in the ordinary way, but in these circumstances he has not time to do it quietly, and the suddenness and consequent strain may hurt the muscles of the back. A history of the case will afford much assistance in these accidents. I have never seen an animal totally disabled. If an elephant after a slip shows any difficulty in rising, very often manifested by the animal trumpeting, the load must be removed forthwith and a couple of elephants brought to give a hand to enable him to rise. Once on his legs after he has finished trembling the mahouts should massage the back in the usual manner, and then take him quietly into camp if he can be moved. Several days' rest may be necessary.

The treatment consists in warm applications to the back, massage (which operation is well carried out by Burman, Karen and Shan mahouts) and the application of strong liniments. When better gentle exercise is to be allowed. It is advisable for some time after such an accident that the animal be loaded lightly; it is also as well not to put him to any heavy work such as *ounging* heavy timber.

FRACTURES AND DISLOCATIONS.

A fracture is a sudden and forcible solution of continuity in a bone. It is quite a rare accident in elephants.

Classification.—A fracture is simple when the skin over it is unbroken, compound when there is a wound extending through the skin and soft structures down to the bone, and comminuted when the bone is broken into fragments or splintered.

Symptoms.—A grating sound which is heard when the broken ends rub together, alteration in the shape of the part, swelling,

pain, loss of power, excessive mobility, inability to bear weight. In a limb there may be shortening. Fractures may be complicated by injuries to surrounding structures such as blood vessels, nerves or other important organs.

Treatment.—If in a limb the animal may be given a chance if a simple fracture, as he may recover with a slightly shortened limb and be able to work in yards, etc. If after three months he shows no signs of being useful, he had better be destroyed.

A dislocation is the forcible separation of the articular end of the bone from the part with which it is naturally in contact. This accident is also uncommon.

Causes.—External violence, falls, etc.

Symptoms.—The general symptoms are alteration in the shape of the joint, inability to move the part and if in a limb alteration in the axis of the limb. A dislocation is distinguished from a fracture by the following:—

The swelling in a dislocation occurs at a joint, the pain is often not very acute and there is no grating sound to be heard.

Treatment.—In some cases there is only a partial dislocation. It is however hopeless trying to reduce a dislocation in an animal over which one has so little control and whose strength is immense.

CRAMP.

Cramp is a spasm of muscle of variable extent, *i.e.*, many muscles may be attacked or only a few.

Causes.—Cold, especially entering water in an exhausted or heated condition.

Symptoms.—The animal suddenly is incapable of using his limbs, which become painful and stiff owing to muscular contraction. In deep water when he discovers his helplessness he loses his head and is drowned. It is a common accident. In these cases of drowning, Burmans attribute cause of death to the bite of a mythical fish, *yesin* (ရေဆင်) or *natsin* (နတ်ဆင်).

RHEUMATISM.

Throughout the muscular system of the elephant there runs a considerable amount of fibrous tissue, and this no doubt has largely to do with the comparative frequency of this malady in these animals. It is a painful affection and owing to its liability to

recur troublesome. The disease affects the muscles, tendons and their sheaths, especially about joints. Recovery is often tardy.

Causes.—Cold is generally regarded as the chief cause. Exposure to wet, damp, cold winds, insufficient shelter, early baths when water is very chilly, working in and out of streams for hours, rapid cooling of the body after exertion.

Symptoms.—The first symptom attracting attention is that an animal is very stiff or even lame without apparent cause. If able to move about there is a shortness in the step, the leg is carried, the joints not being flexed; there is usually severe pain and swelling of the affected parts. There is no fever unless complicated with some other ailment, and the appetite is unimpaired. The groups of muscles most affected are those about the loins, hips, shoulders and extremities, in the latter in the region of the knees, hocks, and about the middle of the fore and hind limbs. Some of the characteristic features of rheumatism are the wandering or shifting nature of the pain from one part to another for instance from a hind to a fore limb, the liability to recurrence, and the fact that the stiffness or lameness wears off or may even disappear after exercise. In my experience rheumatism is a local affection, that is I have never seen the whole muscular apparatus affected in these animals.

Treatment: Preventive.—Must be directed to removal of the causes enumerated above.

General.—Bowels to be kept regular by administration of laxatives (Formulæ 23 to 28). Salicylate of soda in 6-dr. doses mixed with sugar, etc., may be tried with advantage, as also bicarbonate of soda or potash $\frac{1}{2}$ oz. twice a day for two or three days or until pain is relieved. A course of arsenic often does good. Change to a dry climate, which at times can be managed, is most beneficial.

Local.—In this method of treatment friction, and not the drug, plays the most important part. Rest and hot fomentations frequently applied to affected parts, rubbing in with friction liniments (see Formulæ 70 to 75). Hayes recommends the following handy liniment:—Kerosine oil in which as much camphor as it will take up has been dissolved.

CHAPTER VII.

DISEASES OF THE SKIN.

Inflammation of the skin.—The skin in common with other structures is liable to become congested and inflamed. This may merely be superficial affecting the surface of the skin called abrasion, or deep affecting the deeper layers, or subjacent tissues as abscess, and both will necessarily vary in extent.

ABRASIONS OR GALLS

Consist of local breaches of the surface due to friction.

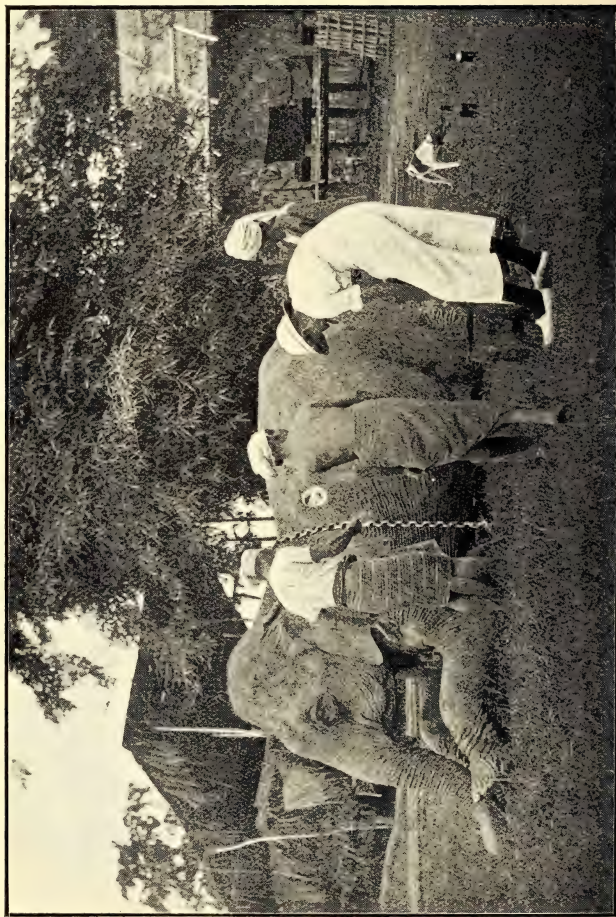
Causes.—Most commonly seen as a result of the chafing of ill-fitting gear, gear ropes and chains, or of fettering or tethering chains, or dirt.

Severe galls may be met with on the legs especially amongst recently captured animals. The raw hide thongs by which the legs are tied together are often drawn too tight, the parts swell and the thongs cut deep into the flesh. These animals in trying to get free strain and twist themselves about to such an extent as to cause nasty cuts with ropes and chains. Animals in *musth* are for the same reason liable to similar injuries. They are sometimes due to carelessness, such as the habit of carrying lengths of chain in the opening of the guddee along the spine, or yards of chain are coiled round a leg and the elephant set free to graze; if not removed regularly, or changed occasionally to another limb, dirt or sand work in, cause friction and soreness of the skin, which if not attended to may lead to nasty sores.

The irritation which has been sufficient to produce an abrasion is often sufficient to produce engorgement of the deeper lying parts, which will be found swollen, hot and tender. This condition is seen usually on the back and is the result of a badly adjusted or heavy load.

The abraded surface is frequently very much smaller than the underlying swelling of the tissues. If this is not immediately attended to, the animal entirely rested, and the abrasion carefully dressed, there is every likelihood of the swelling increasing and becoming an abscess, or the abraded surface which really represents superficial

PLATE XI.



AN OPEN SORE DUE TO AN INJURY.

destruction of the skin may die or slough so as to incorporate the whole thickness of the skin (forming the condition familiarly known in horses as "sitfast"), the slough on separating leaving a hole.

Treatment: Preventive.—Consists of cleanliness both of the skin and the gear with appliances. The gear should always be the best made, as cheap materials are notoriously provocative of chafes and galls. It should always be carefully fitted and adjusted, and frequent inspection of the gear and appliances during work, and readjustment of loads gear when necessary must be enforced. After work when the gear is removed careful inspection for chafes should be instituted. Mahouts from malice sometimes place foreign bodies such as stones under the guddela with the intention of laying up an animal as before remarked under pack-gear. Some mahouts from ignorance or thoughtlessness stow away spare chains into the space of the guddee, which when placed on the guddela forms a convenient receptacle. This is a serious malpractice. To sum up, all preventive treatment consists in thorough supervision.

Curative.—Rest so far as it will remove the offending agent is imperative, by which is meant should there be a crupper gall, and the animal can be worked without the crupper no harm need arise. The raw surface, however small or apparently trifling, should be at once attended to and dusting powders, ointment, applied (*see* Formulæ 64 to 69 and 125 to 129).

Should the abrasion be situated on a swollen base, cold applications should be frequently applied night and day or in the form of cooling lotions (*see* Formulæ 103 to 106) to try and check the condition running on to abscess, but should there be no reduction of heat, pain and swelling within three days, hot continuous fomentations must be substituted to hasten the formation of matter which it may be taken is certain to be forming. These hot fomentations will also assist in hastening the detachment of any dead tissues, should there be sloughing. Those parts where fetters, etc., are applied for tethering purposes are liable to chafes and galls; when this occurs they ought to be placed on other limbs.

In recently captured elephants thongs and ropes must be tied if necessary in a new situation or discarded, and extra fetters and tethering chains put on for security.

In these cases, owing to the danger of approaching the animal, the sores are neglected and maggots gain access; they should be treated as laid down under wounds. The use of a powerful syringe to frequently play disinfectants on affected parts is most necessary in dealing with these wild beasts.

On service it is sometimes necessary to work animals with slight galls. In such cases the injured parts may be relieved by

removal of stuffing from the guddee to form a hollow large enough to take in and protect the part from further injury.

NOTE.—Timely warning here must be offered, which must be applied to all diseases of the skin, abrasions, ulcers, abscesses, wounds, including sprains and lameness from any cause. The practice as usually observed is to put animals into work as soon as ever the diseased condition has been repaired; this is a serious malpractice. The tender new skin which has recovered an ulcerated surface requires several days, if not weeks, to acquire sufficient durability to tolerate conditions which may be applied to a healthy skin in the way of friction and pressure. The same applies to all tissues which have newly replaced diseased ones. An animal therefore should be kept out of work from a week to a month, depending on the severity of the injury after he appears to be thoroughly convalescent. If attention is paid to this matter it will be found more economical in the long run.

PITYRIASIS OR SCURF.

Causes.—Elephants that are badly cared for, and whose general health suffers in consequence, are specially liable to this disease; it however may also occur amongst animals that are irregularly worked but in other respects well cared for.

Symptoms.—A general unthriftiness of the skin which may be hot and very tender. Irritation may or may not be present. If the skin be carefully examined, it may be observed that the scales which resemble dry bran are being cast off on all parts of the body. The hair on the body and tail is easily removed. In some cases the skin may be noticed to be rather harsh, in others it remains soft and pliable.

Treatment.—A change of food and jungle-grazing is usually beneficial in these cases. If the patient has been over-fed, the quantity should be reduced. In cases where debility is present, a liberal allowance is to be made, and the fodder should be clean and fresh. Attention must be paid to the state of the digestion, and also to the action of the bowels. Regular exercise, regulated in accordance with the strength of the patient, is essential. The body should be lightly groomed daily with a soft brush or cocoanut fibre glove and afterwards washed with carbolized soft soap and water, and occasionally with a weak solution of washing soda. Internally, a course of tonics, of which the best results are obtained from the administration of iron or arsenic, or both.

URTICARIA.

Nettle-rash or surfeit may occasionally be met with. It consists of an eruption on the skin, which is usually very sudden in its appearance. The rash may be general or appear only in patches.

Causes.—The more frequent causes are errors in diet, such as sudden changes of food, from poor to luxuriant pasture, allowing animals to drink freely when the body is heated. A high surrounding temperature. Rapid cooling of the skin when the body is overheated. In some animals irritation from insect bites. Well cared for and young animals are very liable to it.

Symptoms.—As a rule there is little or no constitutional disturbance to speak of. The rash appears as elastic lumps of varying size, sometimes being as large as walnuts, and is usually seen about the neck, shoulders and sides of abdomen. The eruption generally vanishes in a day or two and as suddenly as it appears. Fresh attacks may occur from time to time.

Treatment.—Care and attention to watering, feeding and exercise. A dose of physic is usually sufficient to disperse the rash. If the patient is weak, a course of iron tonics generally proves beneficial (*see* Formulæ 41 and 42); bicarbonate of soda in $\frac{1}{2}$ -oz. doses twice daily very often yields good results.

ECZEMA.

Generally speaking skin diseases do not appear to be as frequent or as difficult to treat as is the case with other domestic animals. This may perhaps be due to the fact that elephants are naturally very fond of bathing and in captivity are usually well washed and groomed daily.

Eczema though not a common ailment may occasionally be met with.

Generalized eczema appears to be rare.

Causes.—Usually due to some irritation. It is more common among animals subjected to treatment opposed to their natural habits, such as keeping them tethered in the sun, want of cleanliness as regards bathing, and care of gear, lice, repeated friction due to continued pressure. Defective nutrition of the skin, general debility, digestive troubles, in fact any conditions likely to bring about an unhealthy state of the skin may act as predisposing causes. It is sometimes called mange; this is incorrect. It differs from that disease in that it does not depend on the presence of a parasite,

and is non-contagious. Several animals may, however, be attacked at the same time, but the reason for this is, that generally speaking those that suffer have been partaking of the same kind of food and in other matters subjected to similar treatment. The disease may attack animals in good condition, but is more common and severe in those that are aged or debilitated. The malady is met with most frequently during the hot weather and is liable to recur.

Symptoms.—Irritation of the skin, manifested by a desire on the part of the animal to rub the body against posts, trees; the skin on examination will be found to be hot and tender. This is followed by crops of blisters or vesicles; in the milder cases observed about neck, shoulders and quarters, but in those that are more severe, may also be seen on the head, ears, neck, sides of belly, between thighs and on tail. These vesicles burst the discharge drying on the surface. Successive crops of blisters may appear. In some severe cases the eruption was restricted to the face, sides of chest, the back of ears (in two cases back and front). The ears were especially affected.

Simple eczematous inflammation may pass through several stages, *viz.* :—

- (a) Redness of the skin.
- (b) Papular stage, where small nodules are observed.
- (c) Vesicular stage, where these nodules are filled with fluid (serum).
- (d) Weeping or moist stage, due to the opening of the vesicles themselves or artificially by rubbing.
- (e) Pustular stage, where the fluid is transformed to pus.
- (f) The scaly stage, which is the drying up of the discharged matter either in the pustules or over the suppurating surface.

It must not be inferred that every case passes through these regular stages; some may pass from the first to the last, while in others some of the stages may easily be overlooked owing to the pigmentation of the skin. In severe cases where the face is affected there may be a watery discharge from the eyes, which later becomes whitish and in some few cases the corneæ may become clouded.

Treatment: General.—Attention to proper management. The first thing to do is to secure the animal on a dry standing free from sand and dust, otherwise he will rub himself on trees, posts, etc., causing great raw patches and throw dust on them. The ears are most difficult to deal with owing to the constant flapping. The animal should be sheltered from sun and rain, the standing disinfected to keep flies away. The bowels should be kept regular

and if the animal be weak tonics should be administered, especially arsenic and iron.

Local.—With regard to the local treatment the parts should be washed with soft soap and tepid water, dried and dusted over with a powder of oxide of zinc 1, starch 4 parts, or boracic acid and zinc oxide 2 parts of each, starch 6. Where the ears are very bad resembling an immense sore, it is desirable to have the neck washed morning and evening with disinfectants and afterwards smeared with carbolic oil or some such preparation, so that the ears may come in contact with a clean surface. If there are scabs the crusts should be soaked well with sweet oil or glycerine and when soft removed by washing. The resulting raw surfaces should be cleansed with weak carbolic lotion 1—80, phenyle 1—80, permanganate of potash 8 grs. to the pint, after which dry dusting powders may be employed. If flies are troublesome, a little iodoform or eucalyptus oil may be added, the parts may be dressed with oxide of zinc ointment; boracic acid ointment; *dikamali* ointment; acetate of lead ointment—15 grs. to 1 oz. lard; or white precipitate ointment, ammoniated mercury 1 dr., lard 1 oz., or acetate of lead 1 dr., glycerine 1 oz., water 1 pint. Two or three drachms of powdered borax may be substituted for the lead. In cases where there is much weeping, the parts after being washed may be painted over once with a solution of nitrate of silver 4 per cent. This is often very effective.

The eyes when affected must be treated as laid down under inflammation of the cornea. In one case sloughing of portions of the tail and ears were superadded to the above, but whether dependent or independent of this affection it is very difficult to say.

BOILS.

Boils are frequently met with in this animal confined to no particular part of the body, but perhaps more often seen on the front of face or quarters, inside of thighs and under the belly, but they may be distributed all over the body. They may be either boils which proceed to suppuration, or what are known as "blind boils," that is, they do not go on to the formation of matter and may disappear with or without treatment.

Causes.—Derangement of the digestive organs especially the liver and depravity of blood from any cause. "Intelligent mahouts say they may arise from the too free use of mercury."—(Hawkes.) Others the result of œstrus (larvæ) are dealt with under the section on parasitic disorders due to flies.

Symptoms.—A circumscribed, hard, elevated swelling of the skin, often painful and tender to the touch, not as a rule disposed to come to a head. If a boil bursts, a tough slough of the deeper parts of the skin and even the tissues beneath, commonly called the *core*, is disclosed.

Treatment.—The cause must be sought for: if the digestive system be out of order, the state of the bowels must be attended to and kept regular by means of laxatives, purgatives or enemas, as the strength of the animal may indicate. Small doses of aloes, about 3 drs., or aloin 1 dr. and calomel 30 to 40 grains every alternate day for a week may do good. If the animal be weak, good mixed food, boiled rice, may be given, also some cordial (*see* Formulæ 11 to 14) conjoined with tonics may be administered.

Local.—Foment with warm water and open as early as possible, otherwise the matter may burrow; for procedure *see* Abscess. After evacuation foment and treat as an ordinary wound.

Anti-fly dressings are very useful in these cases, such as *dikamali* ointment, or turpentine ointment:—

Oil of turpentine	...	... 1 oz.
Resin, powdered	...	... 2 drs.
Wax	...	... $\frac{1}{2}$ oz.
Lard	...	... $\frac{1}{2}$ oz.

* Melt these together in a water bath.

OR

Camphor	...	... 1 part.
Sweet oil	...	... 4 parts.

OR

Venice turpentine	...	... $\frac{1}{2}$ oz.
Sweet oil	...	... 4 ozs.

Melt together and strain.

HÆMATIDROSIS—BLEEDING OF THE SKIN.

On one or two occasions it has been noticed that in herds certain animals show drops of blood about the body. If the hand be rubbed gently over the affected parts it is covered with blood. Several elephants may be suffering at the same time. In most cases noted the skin along the abdomen was affected, but in some the quarters, between the legs, and in one or two the under surface of the neck and the shoulders were the seats of the affection. The cases were observed during the hot season, the animals ate well, and in other respects were said to be all right. Flies were not at all bad or at least not sufficiently numerous to cause so much trouble.

The only reason that could be assigned was that the animals were, and had been for some time, on dry coarse fodder, and that there was a general disturbance of nutrition of the blood vessels. Some animals which had recovered presented a spotted appearance and at each of the hæmorrhagic points the skin had lost its pigment.

The treatment consisted in regularly washing parts with weak antiseptic lotions and giving internally arsenic and bicarbonate of soda.

Hæmorrhages of this kind occur in cattle and in certain breeds of horses. In some cases the hæmorrhage may be due to the presence of minute round worms (*filariæ*).

CHAPTER VIII.

DISEASES OF THE SKIN (*continued*)—EXTERNAL PARASITES.

BLOOD-SUCKING FLIES.

These huge creatures are not exempt from the annoyance of flies; mosquitoes even causing them great irritation.

Fleming in his "Animal Plagues" mentions that—

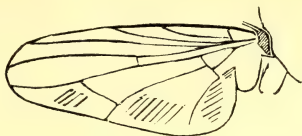
"A.D. 260. When Saphor, King of Persia, was besieging Nisibus, his elephants and beasts of burden were so suddenly and furiously attacked by swarms of gnats as to kill or disable them, thus causing the siege to be raised, and subsequently leading to the discomfiture of that monarch's army."—(*Theodorite, Hist. Eccles*, Book II, page 30.)

Steel, page 53, also records that "the tsetse-fly in South Africa has proved a serious enemy to the elephants, its poison giving rise to anthracoid symptoms and rapidly fatal results."

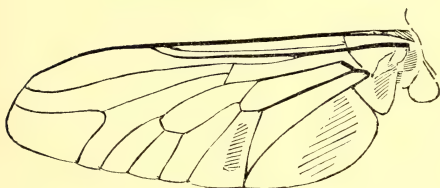
Selous in his work "A Hunter's Wanderings in Africa" makes frequent reference to this fly, which he describes as the "most abominable of all created insects."

In Burma in certain tracts, and at certain seasons of the year, flies and other pests are very troublesome to all animals. This is especially the case after the first few thunderstorms towards the end of the hot weather and also during breaks in the monsoon. On the appearance of an animal they swarm out of the jungle and attack it, and owing to their numbers and the severity of their bites often cause much irritation and soreness of the skin. When flies are about, elephants like other animals become agitated and with ears flapping, tails and trunks swinging, make very rapid journeys in order to escape from their tormentors. Certain flies appear to be more or less confined to particular areas suitable to their phases of development and mode of life. As a rule they confine themselves to the proximity of water or damp areas where vegetation, etc., is usually luxuriant, though by reason of winds or other agency they may be found at some little distance from their place of origin. The agency of several species of blood-sucking flies in the transmission of certain diseases

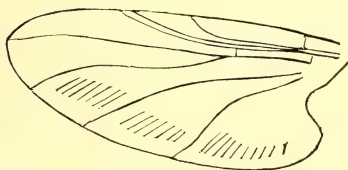
WING NEURATION OF SOME OF THE MORE IMPORTANT BITING
FLIES AS COMPARED WITH THE HOUSE-FLY.



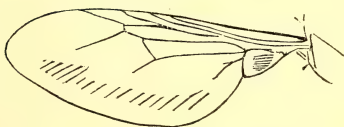
Muscidae (restricted)—House-fly (*vin*).



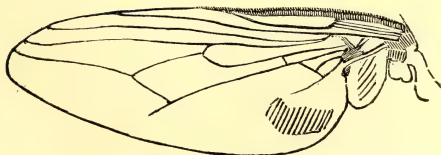
Tabanidae—Horse-fly (*hmet*).



Simuliidae—Blood-blister fly.



Hippoboscidae—Spider-flies.



Glossina—Tse-tse fly.

such as malaria, surra, n'gana (tsetse-fly disease), sleeping sickness, etc., has been fully established.

There are several varieties of blood-sucking flies in Burma and the Shan States. Blood-sucking is generally confined to the female sex.

Sand-flies	...	...	...	Hpyðk.
Simulium	...	{ Blood-blister fly }	...	Po-laung.
		{ Buffalo gnat }		
Mosquitoes	...	...	...	Kyin.
Stomoxys	...	...	...	{ Yin-ye.
				{ Yin-kya.
		Horse flies	...	Hmet.
		Breeze flies	...	Hmet-gyi.
Tabanus	...	{ Sometimes called		
		gad-flies	...	Hmet-kya.

The *hmet-gyi* is the large horse-fly and is not anything like so plentiful as the *hmet-kya* or smaller *hmet* which swarms on to animals causing herds to run away.

Taungpyauk (တောင်ပျောက်) is an Upper Burma name for the *hmetkya*.

Sand-flies and mosquitoes need no description to those concerned with this work; nevertheless, of all the biting flies at present known, the mosquito ranks first in importance as it has been conclusively proved that certain species take a prominent part in the diffusion of certain diseases such as malarial fevers, filariasis. Furthermore they act as hosts in which the germs pass a certain portion of their life cycle, hence without these insects the parasites could not exist.

Simulium (The blood-blister fly).—This is common enough in certain localities and where found is a regular pest. They are well known to visitors to the hill station Thandaung, and are particularly troublesome in parts of the Salween. It is a small blackish hump-backed fly, part of the abdomen is yellow; flight is noiseless. In human beings at the time of biting no inconvenience is caused, but later the bites become very irritable and in some individuals there is considerable swelling of the parts. The seat of the bite may be distinguished by the presence of a small globule of blood under the skin.

Tabanidæ.—Several species of this order are to be found in Burma and some of them are amongst the largest of Diptera, many of the horse flies measuring quite $\frac{3}{4}$ to 1 inch in length. Some 1,500 species have been described, the majority belonging to the genus *Tabanus*, the other principal genera being *Hæmatopota*, *Pangonia* and *Chrysops*. They are voracious blood-suckers and cause very irritating bites and are much dreaded by all animals whose skins can

be assailed by them. They are heavy, large bodied flies, in size ranging from $\frac{1}{4}$ to 1 inch in length. The head is large, convex in front, eyes usually greenish in colour, but in some species may be of other brilliant colours. Eyes in the male meet, but in the female there is a space between them. Proboscis in most genera is short and stout. Colour of the body varies, usually greyish. In some especially the smaller kinds the flight is noiseless, the first intimation of their presence being their sharp bite. The eggs are deposited on rushes or other smooth surfaces over water or damp ground. It is probable that at least some of the genera of this species aid considerably in the dissemination of surra.

Stomoxys.—Different members of this genus are very similar to each other. In appearance and size they so closely resemble house-flies as to easily deceive at a casual glance. Their most readily distinguishing feature is the little short proboscis, which projects horizontally in front of the head and if looked at closely will be seen to be bent like an elbow joint. This fly bites freely, as will have been noticed by any who has stayed any time near buffaloes in the rains. It can easily bite through an ordinary stocking. It has been recognized as one of the agents in the transmission of La Souma (a surra-like disease in the Soudan), and probably may help to disseminate surra in this province.

A most important member of the genus allied to the *Stomoxys* and so far not recorded from Burma is the *Glossina* or Tsetse-fly of Africa, the dreaded agent which causes the "fly sickness" of certain tracts in that continent. In view of its possible presence or perhaps introduction into the country, a short description may with advantage be given. They are brownish or greyish brown flies. Length $\frac{1}{4}$ to $\frac{1}{2}$ inch, and have a very prominent proboscis. In the resting attitude they may be distinguished from biting-flies of a like appearance by the fact that the wings are closed tightly, overlapping each other like the blades of a pair of scissors.

During the "fly season" when animals are tethered during the day but more especially during the night, fires should be lit near their standings. Animals readily recognize the value of smoke as a protection against flies. Mosquitoes are so numerous in many places during the rains that without fires domestic animals can hardly obtain rest. Sand-flies and mosquitoes are the chief tormentors, but sometimes *Tabanadæ* will bite after sunset, by moonlight, and even when dark. This I have been made aware of by personal experience when in the vicinity of cattle more particularly buffaloes. Selous* remarks, "I think it is usually believed that the tsetse-fly

* "A Hunter's Wanderings in Africa." Page 154. F. C. Selous.

will not bite at night, but along the Chobe river (where they swarm), and by moonlight, I can feelingly say that this is a mistake. They kept flying up from the ground on to my naked legs, and bit as furiously as in the day-time."

Wild elephants and buffaloes usually protect themselves by wallowing in mud-holes, thus coating their bodies with mud. Cartmen when starting on the march often tie a smoky wood-oil torch to the front of the yoke while carrying another to protect themselves and the hind parts of their oxen.

NON-BLOOD-SUCKING FLIES.

Certain non-blood-sucking flies require notice owing to the fact that their larvæ as maggots occur in wounds, others causing "warbles" under the skin, or appearing as internal "bots" cause much trouble.

Maggots.—The large sarcophagus (*S. magnificata*) and the common carrion-fly (*Musca cadaverina*, ထောင့်ချောင်း) are probably the most common ones which lay their eggs in wounds, ulcers, etc., the resulting maggots setting up intense pain and irritation and delaying healing.

It is not proved that the blue flesh-fly (*Calliphora vomitoria*, ထင်မခံရောင်း) nor the carnivorous sarcophagus (*Sarcophaga carnaria*, ထင်ကြီး) deposit their eggs and larvæ in wounds.

In a neglected wound the presence of maggots may be suspected by approaching the nose near the wound, when usually a foetid odour will be detected; there is also generally a thin offensive discharge.

When a small opening exists, the wound should be opened up and the maggots that can be seen removed gently by means of forceps. There are usually many more present which have burrowed and are lying in pockets, hence it is necessary to keep a close watch for two or three days.

The application of certain drugs causes them to emerge from their hiding places; such are carbolic lotion 1 to 40, powdered camphor alone, or dissolved in spirit or mixed with oil, oil of turpentine or eucalyptus oil mixed with sweet oil. In fact almost any essential oil diluted with sweet oil helps to effect their removal.

Warbles (parasitic boils).—The family *Æstridæ* are all distinguished by the necessary parasitism of their larvæ. According to the species they develop in suitable localities in different mammals. Sometimes it is the stomach which is chosen, and the larvæ then known as internal "bots" are treated of under the

chapters on internal parasites. In others the suitable region is the subcutaneous tissues of the selected animal. Warbles or swellings due to the invasion of the subcutaneous tissues by the larvæ of one or more of the family æstridæ (gad-flies) are very common in elephants in various parts of the province from the Chindwin to Tenasserim. As a rule they are numerous, but in some cases in the Meza forests mentioned by Mr. Petley of Messrs. Steel Brothers, the infestation was remarkable. He describes it as follows:—

“The elephants from which these ‘bots’ were taken literally swarm with swellings in all parts—head, ears and body. The scars of recent eruptions are in some parts of the body so closely pitted as to impart to the skin a honeycomb appearance, showing that thousands of the parasites have burrowed out during the last few months. Curiously enough, only the elephants brought from India last year are affected, and no doubt their general unhealthy appearance is due to the presence of myriads of ‘bots’ beneath the skin. In the elephants from which the specimens were taken the numbers were almost incredible.”

How the larvæ reach the subcutaneous tissues has not yet been rightly explained. Many theories have been advanced, but the more common one would seem to favour the idea that the egg is deposited directly on the skin and the larva in the initial stage of its development gains inlet either by the hair follicles or sebaceous glands to its resting place.

Symptoms.—Swellings, so-called boils or warbles, of varying size. When the larvæ are well developed towards the end of April and May (most commonly here) they produce inflammation and supuration about them producing the so-called warbles. When the larvæ are ripe they quit their abodes, usually stern first, after widening the openings.

Treatment.—When the nature of the swellings is recognized a little pressure applied to them will materially assist in setting the larvæ free. The abscesses should be treated in the ordinary manner. The larva of this fly is about $\frac{1}{4}$ inch long and consists of some nine segments. The larvæ should be destroyed.

THE HIPPOBOSCIDÆ—SPIDER-FLIES.

These well-known insects may occasionally be observed on elephants. They probably come off cattle or ponies, on which animals they may be found frequently about the smooth parts of the body, *i.e.*, between the thighs, around the arms and on the perinæum. They are flat, have a broad body which is leathery especially the

abdomen, which in the female is capable of great distension. The legs are strong and terminate in claws. The wings are obtuse and rounded, and the veins are confined to the anterior third. They can run with great rapidity, are difficult to catch and not easy to crush owing to their leather-like skin. In some animals they cause great annoyance, one or two being sufficient to cause them to kick furiously.

TICKS.

Ticks (𐑁𐑃𐑄) are plentiful enough both as regards species and numbers. They are blood-suckers; the mouth is provided with a serrated rostrum or beak, by means of which they can pierce the skin and retain a firm hold. More important, however, than the annoyance caused by their fixation to the skin is the fact that in recent years it has been proved that several species are responsible for transmission of certain diseases in man and various animals. What particular ailments may be carried amongst elephants by ticks have not been established, but it is extremely probable that piroplasmosis affecting these animals is at least one of them. As far as they have been recognized, elephant ticks belong to the family Ixodidæ; it is unlikely that the members of the family Argasidæ will be found owing to the conditions under which these latter live. It is advisable that all ticks be removed as soon as seen, but care should be taken not to remove them forcibly: they are likely to leave their heads behind, nasty sores resulting from the irritation. They may be induced to release their hold by applications of turpentine and oil, or by adding a little crude earth oil or kerosine oil to some ordinary sweet oil. If an animal is badly infected the following dressing, noted in one of the Queensland Agricultural Journals, may be employed. It is very effective in dogs:—

Soft soap	...	...	4 ozs.
Kerosine	...	...	1 tea-cupful.
Water	...	...	1 qt.

Boil soap and water together till soap is dissolved. When cool add the kerosine and agitate the mixture thoroughly for five minutes with a rod. Wash the affected parts with some of the mixture.

LICE (𐑁𐑃𐑄)—HÆMATOPINUS.

Most animals have a special species and the elephant is no exception. The hæmatopinus of the elephant is a large blood-sucking parasite of a reddish colour and rather active.

The situations in which they are most likely to be met with are the head and neck, under the abdomen, about the root of the tail. In some cases they may be noticed on all parts of the body. The eggs (nits) are attached to the hairs.

Though lice may infest animals in the best condition they are more common on those that are ill kept and badly nourished. Their presence is usually an indication of neglect.

Symptoms.—Constant itchiness and consequent rubbing, loss of hair and shedding of the superficial layer of the skin. Careful inspection reveals the presence of lice and also their eggs.

Cobbold in his *Treatise on the Entozoa of Man and Animals*, page 399, notes: "A species of mite has been described whose generic position appears doubtful. I allude to *Homopus elephantis* of *Furstenberg*, or *Symbiotes elephantis* of *Gerlach*. According to *Mignin* it is *Nymphe adventive* or *hypope* of a variety of *Tyroglyphus siro*. This *acarus* is abundant in old forage. Another ectozoon is *Hæmatomyzus elephantis*. It differs from the lice proper in many respects, but, according to *Piaget*, the reproductive organs resemble those of *hæmatopinus*. In 'Science Gossip' for June, 1871, *Mr. H. C. Richter* describes 'a new form of parasite' which is called *Idolocoris elephantis*. The insect, which was one line in length, was found upon an elephant in Ceylon. According to *Walker* it not only constituted the type of a new genus, but of an altogether new family of the *Hemiptera heteroptera*, coming very near to the bed bugs (*Acanthidæ*). It is a huge sucking louse. From the discussion which followed, it seems that the parasite had several times been seen before, and was none other than *E. Piaget's Hæmatomyzus elephantis*. Excellent figures accompany *Richter's* and *Piaget's* descriptions."

Treatment.—Immediate segregation of the affected animal. The body must be thoroughly washed, preferably with carbolic soft soap and water, after which, from experience with other animals, the following dressing recommended by *Adams* may be applied:—"After drying, apply to every part of the skin a mixture of tobacco water and sulphur $\frac{1}{2}$ an ounce of each, to a pint of boiling water. This must be applied for two consecutive days, and on the third day the horse must be again washed as before. It will be seldom found necessary to repeat this." This dressing he remarks "has the advantage of being simple, ready at hand, not likely to do harm if used with ordinary caution, inexpensive and effectual." The lice are killed easily enough, but the eggs or "nits" are difficult to destroy. Other dressings in which a little tar or turpentine is mixed with oil act well, as also does plain decoction of tobacco leaves $\frac{1}{2}$ an ounce to a pint of boiling water; the vessel should be

covered and allowed to stand for half an hour or so, after which the liquid may be strained through a piece of calico. If the elephant has been standing in a shed, it is essential that all woodwork be thoroughly washed with boiling water, to which crude carbolic acid or phenyle has been added. All gear had better be destroyed by fire, or at least be saturated with carbolized boiling water. This should be repeated daily for two or three days.

Poultry, which are proverbially full of vermin, should not be allowed in elephant sheds.

LEECHES (မြေခွံကျွတ်).

Family *Hirudinæ*. During the rains the large water and land leeches may attach themselves and when fixed will suck blood freely until they become distended to very many times their original size. They should not be removed forcibly. The ordinary Burmese method, namely to place the lighted end of a *sèlaik* (Burmese cheroot) in close proximity to their bodies soon causes them to relax their hold.

CHAPTER IX.

DISEASES OF THE FEET.

TENDER FEET OR "THULLEE."

This is a very common ailment.

Causes.—Continued marching over hard or stony ground during hot weather; it also occurs amongst animals that are marched first through swampy grounds and then over stony or rocky country. In some cases, where animals have been kept on dirty standings, the soles are quite soft. Steel mentions that elephants employed in heavy draught are liable to overwear at the junction of the hoof-slipper with the skin.

Symptoms.—Short action, at times lameness. If the feet be examined, the tender parts will be at once seen; they are quite smooth and of a yellowish or pinkish colour, and if pressed the animal shows evidence of tenderness.

Treatment.—Regular inspection of the feet; if a tender patch be observed, the animal should be rested forthwith. The standing should be of dry earth, not sand. Rest and keeping the feet dry is the only treatment. Mahouts to prevent the occurrence use astringent mixtures, called *chobing*, which have been found of practical value. Hawkes recommends—

Aloes (<i>mók</i>)	...	...	24 tolas.
Wax (<i>hpa-young</i>)	...	...	24 tolas.
Dammer (<i>pon-nyet</i>)	...	...	24 tolas.
Grease	...	...	24 tolas.
Catechu (<i>sha-sè</i>)	...	...	96 tolas.

Melt together and apply as an ointment to the feet.

One tola equals 3 drs.—*Hawkes.*

Steel, condensing one of Gilchrist's formulæ for *chobing*, gives the following prescription :—

Catechu, powdered (<i>sha-sè</i>)	...	12 ozs.
Galls, powdered (<i>pyin-sa-ka-nè</i>)	...	1 lb.
Wax, powdered (<i>hpa-young</i>)	...	2 lbs.
Gingili oil (<i>hnan-si</i>)	...	4 lbs.

Melt together and apply to the soles of feet night and morning.

Take a large quantity of the bark of the "jack" (*peinnè*—*Artocarpus integrifolia*) and palmyra (*htan*—*Borassus flabelliformis*) trees; boil with plenty of water for about four hours till reduced to about 6 or 7 quarts, then strain it through a cloth and while hot add the following:—

Catechu	...	...	...	2 ozs.
Soda	...	...	...	2 ozs.
Wax	...	...	...	4 ozs.
Sweet-oil	...	...	...	2 bottles.

To *chobe* the feet the animal is made to lie down as when sleeping; the feet must be thoroughly cleaned by washing, after which apply the *chobing* warm; this may be carried out with a mop. *Chobing* is an excellent thing for hardening the soles of the feet.

INFLAMMATION OF THE FEET OR LAMINITIS.

In this ailment the sensitive sole is the chief seat of inflammation; the lameness is always severe, so much so that the animal is unable to stand for any time, so lies on his side. There is heat and tenderness all about the foot and there may be oozing at the margin of the hoof-slipper. There is considerable fever.

Causes.—Prolonged work, especially marching over hard ground during the hot-weather months. It may also result as part of a general chill, when an elephant fatigued by exertion is taken into cold water. Steel mentions as causes high feeding, too free use of *massauls*, and that it may occur as a complication in foot-and-mouth disease.

Symptoms.—Lameness; the animal sometimes being unable to stand, lies on his side; high fever; great heat around the foot-pad.

Treatment: General.—As laid down for fever.

Local.—Envelope the feet in blue clay (*shun*, 𑂔𑂗𑂢𑂰), or stand the animal in wet mud, or cover with gunny and keep constantly wet with cold water; if bran be at hand cold poultices may do good. In some cases fomentations afford great relief.

Steel mentions that shedding of the hoof-slipper is not uncommon on account of effusion between the horny structures and the sensitive parts which produce them. It is necessary to keep a sharp look-out for such complications. Steel notes that death has been known to result from mortification. In the event of the hoof-slipper being cast, the foot must be kept perfectly clean and thoroughly protected till a new slipper has been produced.

CRACKED SOLE.

This is a condition in which ulceration takes place in the natural cracks or crevices of the sole. It is a most troublesome affection and difficult to cure. In some cases proud flesh occurs.

Causes.—Generally affects animals that are constantly working in water such as many timber animals have to do ; bad sanitation is another and not infrequent cause.

Symptoms.—The affected parts appear sore ; there is often a nasty oozing discharge from the cracks, and in severe and neglected cases there may be raw fungus-like growths. Some animals suffer so much pain that they are disabled.

Treatment.—In this affection cleanliness and keeping the feet dry are all-important. While the animal is down, poultices may be applied ; bran sprinkled with phenyle, or carbolic acid lotion, or bran and powdered charcoal poultices are useful (*see* page 136). When the feet are cleaned, they may be washed with some mild disinfectant ; then dried and some dry dressing, as equal parts of boracic acid, oxide of zinc and iodoform, should be employed. A pad of tow should now be applied, then a bandage and over all a gunny-bag to keep the tow in place. The foot should then be enveloped in a leather boot, or a boot with wooden sole and leather upper. If there is any tendency to proud flesh, it should be kept down with blue-stone or some other caustic.

An excellent ointment for use in this ailment, and also for nasty ill-conditioned sores about the feet, etc., is made as follows :—

Powdered alum	...	...	1 dr.
Subacetate of copper	...	...	1 dr.
Strong acetic acid	...	...	$\frac{1}{2}$ dr.
Vaseline	...	...	1 oz.

Melt the vaseline, then add the alum and copper and stir well ;
when almost cold, stir in the acid.

The following dressing may also be tried :—

Sulphate of copper	...	...	1 part.
Tar	...	...	8 parts.

Mix and heat together over a slow fire.

Dry calomel may be introduced into the cracks, or a small quantity of burnt alum. The following recommended by Tuson also makes a convenient dressing :—

Tar	...	...	2 parts.
Soft-soap	...	...	1 part.
Linseed meal sufficient to impart tenacity to the mixture.			

This dressing may be applied when the animal is convalescent, at which period he may be sent out with an attendant, who should take care that the animal does not enter water.

Slym recommends for this affection the following dressing :—

Bark of the jack tree	...	...	A good quantity.
Substance of the palmyra palm trunk	...	...	A good quantity.

Boil with water a good quantity, or so much that, after about four hours, a gallon or more is left ; strain, and while hot add—

Catechu	...	...	6 ozs.
Soda	...	...	6 ozs.
Wax	...	...	8 ozs.
Oil	...	...	3 qts.

Make the elephant lie down and apply the above with a piece of cloth after cleaning the crevices (Formulæ 133 and 134).

Arsenic may be given internally : either *liquor arsenicalis*, half an ounce morning and evening, or arsenic, 2 grains morning and evening for ten days or so, after which it should be discontinued for a few days during which time other tonics should be substituted.

CRACKED HEELS.

This condition is the *sajhan* of the natives of India.

Causes.—Bad management, as it is seen usually in animals kept on filthy standings ; those allowed to stand for days together in slush, and those that have to work timber daily in water. Forsyth attributes it also to constitutional causes, and remarks that it is a serious unsoundness owing to its liability to recur every rains.

Symptoms.—Consist of a cracked condition of the foot, usually about the junction of the horny sole and the skin, from which a discharge may issue.

Treatment : Preventive.—Animals that have to work in water should be carefully inspected after work and, on the slightest appearance of any cracking, the matter should be reported and the animal rested or changed to other work.

Curative.—Clean and thoroughly dry standings if possible on cement or boarded floors ; on no account should an animal be allowed to enter slush or water ; he should be bathed away from a stream. The affected parts are to be cleansed thoroughly daily with phenyle (1—60), or carbolic acid (1—60), or Condyl's fluid 1 ounce to the pint, and the parts dressed with carbolized vaseline or oil, oxide of zinc ointment, or boracic acid ointment, or with powdered boracic acid and iodoform, equal parts, or iodoform, oxide of zinc and starch, equal parts. If discharge is profuse, acetate of lead,

1 drachm to 12 ounces, or sulphate of zinc or copper, 4 or 5 grains to the ounce of water, should be applied once daily. An occasional application of weak solution of chloride of zinc proves beneficial. The affected parts must be covered with tow and the foot enveloped in sacking; on recovery the animal should not be worked in water for two or three months.

ABSCESS OF THE FOOT.

Causes.—The sole of the foot is comparatively thin and nature intended it for transit over soft ground; it follows therefore that when an animal is put to constant work on hard roads or rough country, especially when the work is carried on for protracted intervals, the slipper or sole becomes unduly worn and attenuated, and in this condition may very easily be severely bruised or wounded by blunt bodies, and abscess is very likely to arise.

Symptoms.—Are the same as already described, with no swelling, or at least so slight as to easily escape notice; intense pain (especially when pressed with the fingers), to which lameness is superadded, or the animal by his posture may arouse suspicion such as constantly resting the affected foot. Inflammation as in other parts is apt to extend, in which case heat and puffiness may be observed around the hoof-slipper or even above the nails. Matter frequently, owing to its being unable to find an exit at the sole, burrows upwards and escapes above the nails at the junction of the slipper with the skin sometimes leaving a passage or sinus.

The temperature should always be taken.

Treatment.—As soon as an animal shows signs of lameness the foot should be examined most carefully for wounds. By gently tapping the sole with a hammer, if any tenderness is evinced, or if any undue heat can be noticed with the hand, the animal should be rested, and if this is done early enough trouble may be averted; the sole must be thoroughly cleansed with brush and carbolized soft-soap and water and a cold bran-poultice applied; but if this does not reduce the heat and tenderness in twenty-four hours or thereabouts, hot fomentations should be substituted and the temperature taken every four hours or so; for if the inflammation is of a severe character the thermometer is sure to show a rise, in which case there should be no delay in opening the abscess. In this situation owing to the horny nature of the sole, it should be pared over the seat of inflammation till quite thin before using the knife; this procedure should immediately be carried out in the case of punctured wounds in anticipation of future mischief. After this,

treat the abscess as described. If a fistulous opening appears in the parts abovementioned, injection of sulphate of zinc or copper, 2 to 5 grains to the ounce (*see* Formulæ 98 to 102) should be tried, and if necessary repeated and the parts dressed. In all injuries of the feet the foot should be dressed, enveloped in gunny and placed in a leather boot.

DISEASE OF THE NAILS.

Warty growths around the nails.—This is not a very rare affection amongst timber-working elephants, especially those that constantly work in water; these growths, which resemble warts around the top of the nails, do not as a rule give trouble while animals are working in dry places; but when worked in water, they often soften and ulcerate, sometimes causing nasty angry sores. The animal is not ordinarily incapacitated from work, nor does he go lame.

Treatment.—Keep the animal out of water, the feet dry and clean, and treat sores on general principles.

Ingrowing and overgrown nails.—Elephants especially those that work much in water are liable to ingrowing nails. Again injuries to the feet, such as frequently happen while elephants are walking about logs, may cause one or more nails to grow out in an unnatural manner.

An ingrowing nail may cause much pain and lameness. Sometimes a little proud flesh is noticed about the position where the nail is buried.

Treatment.—Remove with a sharp knife. If the animal is kept standing for some hours in water, the nail is softened and can be cut; moreover owing to the effects of the cold, the amount of pain caused during operation is diminished.

When nails are overgrown, the offending portion may be removed with a fret-saw; but if the foot has been placed in water for an hour or two, an ordinary strong sharp knife will be found to answer the purpose.

MOISTURE AROUND AND UNDER THE NAILS.

Causes.—Usually bad sanitation or standing continually in wet places.

Symptoms.—Itchiness manifested by the animal rubbing one foot against the other. If the nails are pressed, a nasty smelling

discharge may be observed issuing at the junction of the nails and skin and also from beneath them. These cases are at times troublesome, especially when there is much discharge from under the nails.

Treatment.—Cleanliness and keeping the feet dry is essential. The affected parts should be thoroughly washed at least once daily with some antiseptic lotion, and dressed with iodoform ointment, dry calomel, carbolic acid ointment. As the case improves tar dressing may be applied.

Most affections of the feet are due to want of proper care and management.

GUNRUSS AND CHOWRUNG.

These are terms applied by native mahouts to certain affections of the feet. In the former, only the fore-feet are attacked; in the latter, the limbs and all the feet are involved.

Gilchrist and Hawkes state that the condition known as *gunruss* supervenes in some animals that have been allowed to take their rice during the time they were eating earth. It is manifested by stiffness and a turning outwards of the feet, but except in severe cases locomotion or efficiency of the affected animal is not impaired.

Chowrung—Is an aggravated form of the above. It may arise from chills or from crossing rivers when the body is heated.

Treatment—Is to avoid the causes such as mentioned. The patient should be protected from cold, rain, and given stimulants and good food. Many of these cases are probably rheumatic.

CHAPTER X.

DISEASES OF THE RESPIRATORY TRACT.

CATARRH OR COLD.

Symptoms.—Constant dribbling of watery or opaque fluid from the trunk ; watering from the eyes. The eyelids may be swollen and half closed. The body may be cold or the surface temperature uneven. The animal is listless ; there is loss of appetite and considerable thirst. Constipation is usual. The causes which produced the condition in this tract may affect other parts ; hence diarrhœa may be present. If care is not taken, severe cases may run on to more serious trouble such as inflammation of the lungs.

Treatment.—Keep the animal in some sheltered place and if very damp and cold throw a tarpaulin over the body. Allow plenty of freshly-made gruel to which may be added salt or sugar. Tempt the appetite with sugar-cane, fruits, young grass, etc.

Extract of belladonna	...	1 dr.
Chlorate of potash	... ..	2 drs.
Aniseed	... ..	3 drs.
Honey	... ..	A sufficiency.

Should be mixed into a thin paste and given three times a day.

OR

Camphor	... ..	2 drs.
Aniseed	... ..	$\frac{1}{2}$ oz.
Liquorice	... ..	$\frac{1}{2}$ oz.

Twice or thrice a day.

OR

Sweet spirits of nitre	... ..	2 ozs.
Liquor ammonia acetatis (dilute)	... ..	4 ozs.

Soaked in boiled rice with sugar or treacle. Twice daily.

A common native *massaul* is to take 9 drs. each of the following :—

HINDUSTANI.

Bdellium (Balsamodendron agalochia)	(googul)	} Add a sufficiency of wheat flour to make into three boluses and give one night and morning. ... 1 oz., may be used in- stead of the borax.
Mustard seed (Sinapis nigra)	(rye)	
Turmeric (Curcuma aromatica)	(huldee)	
Assafœtida (Ferula assafœtida)	(hing)	
Borax (Biborate of soda)	(sowhaga)	
Omum seed (Ptychotis ajwan)	(ajwan)	

Stimulants of any kind may be given with advantage.

MUMPS OR SORE-THROAT.

Causes.—Sudden chills and exposure to cold winds when heated.

Symptoms.—Fever with its attendant signs : swelling about the throat and adjacent glands (parotids), difficulty in breathing and swallowing. In extreme cases the throat may be so involved that the animal may suffocate. Gilchrist states that in some cases food becomes impacted in the gullet causing mortification of this organ.

Treatment : General.—Only allow gruels, linseed tea, boiled rice while there is any difficulty in swallowing ; protect the animal from the weather ; if he will take it, allow nitrate of potash in 1-oz. doses in the drinking water. The following will be found useful :—

Extract of belladonna	...	} 4 drs. of each.
Powdered camphor	...	
Powdered chlorate of potash	...	
Powdered nitrate of potash	... 1 oz.	
Powdered liquorice	... 4 ozs.	

To be mixed and well rubbed down with 8 ozs. each of honey and jaggery. It should be made into a thin paste. A little of this should be taken and rubbed in the mouth every hour or so.

Local.—Enemas to relieve the bowels, frequent hot fomentations to the throat, and mustard or mustard and turpentine or other embrocation (Formulæ 70 to 73) rubbed in. Steel recommends steaming through the mouth with infusions of *nim* leaves (ဝေဝရွတ်, *ta-ma-ywet*—*Melia azedarach*).

BRONCHITIS.

Definition.—Inflammation of the mucous membrane lining the air-tubes in the lung.

Causes.—As in pneumonia.

Symptoms.—If acute, fever with its attendant signs : cough, wheezing and laboured breathing.

When chronic, symptoms are very similar ; only fever is usually absent.

Treatment.—In acute cases as laid down for fever employing enemas in lieu of purgatives, supplemented by the following :—

Ipecacuanha	...	1 dr.
Camphor	...	2 drs.
Squills (powder)	...	2 drs.
Liquorice (powder)	...	1 oz.

Twice or thrice daily.

OR

Myrrh	...	...	3 drs.
Assafœtida	...	...	3 drs.
Aniseed	...	...	1 oz.

Twice daily.

Embrocation should be rubbed into the chest.

Bamboo leaves are very often given to animals suffering from cough.

PNEUMONIA.

Inflammation of the lungs.—Elephants like other animals are subject to this disease but it is not often diagnosed. In the elephant the lungs are lightly lobulated; there are only two large bronchial tubes; the substance of the lung is plentiful. When healthy, on section they are soft under the knife. In elephants inflammation may exist and not excite suspicion owing to the lack of the more prominent symptoms seen in other animals, and death may result without much warning.

Causes.—Chills from exposure to cold winds and wet; over-exertion.

Symptoms.—Temperature generally high and lasting some few days; there may be shivering at the beginning. The pulse is quickened, the breathing hurried and the chest is found to move little or not at all during respiration, but the belly moves unusually during the act. The animal rarely lies down, is very dull, disinclined to move about though there is marked restlessness and often prostration. Gilchrist states an animal "frequently opens its mouth and coughs several times in an hour." Pneumonic cough is generally short and painful, and there is usually a slight yellowish discharge from the trunk; yawning is a frequent symptom. The mucous membranes are highly reddened. The appetite is almost lost; there may be considerable thirst. The bowels are constipated and the surface temperature may vary. The disease reaches its height in a few days and death may take place from suffocation. If the animal survives, the lungs gradually recover their normal condition and function. Recovery may be quite complete within three weeks. In some cases, such as in old and feeble animals, the condition may become chronic. In these cases the animals with careful nursing recover, or death may occur in six or eight weeks.

At times the inflammation is so severe that the diseased parts may mortify and death is the usual result. This untoward event

is characterized by a more or less sudden subsidence of the symptoms—great prostration, rapidity and weakness of the pulse, sunken eyes and markedly fœtid breath. Sometimes an abscess or abscesses may form and the condition may be suspected by a continuance of the fever, coldness, shivering fits and marked dulness.

Treatment: General.—Careful nursing and attention to diet are of the first importance. The animal should be placed in a sheltered position, out of wind and rain. With regard to diet, plenty of freshly-made gruel. Fruits and fresh grass in small quantities should be offered frequently. Stimulants such as whisky, brandy, rum, in 8-oz. doses every few hours, are very beneficial.

If the temperature is high, euquinine in doses of a drachm to one and a half drachms may be given every four hours till the temperature falls, or sweet spirits of nitre in 3-oz. doses every few hours, or nitre in 4-dr. doses every four hours in drinking water. It is as well not to give more than one and a half ounces nitre in all.

When the breathing is distressed, alcoholic stimulants and hot fomentations to the sides tend to relieve the animal.

In pneumonia watching the animal and maintaining the strength are the chief points to be attended to.

During convalescence moderate exercise, nourishing but not too much food, should be given; also Tonics (*see* Formulæ 39 to 46).

Local.—Blankets wrung out of hot water as hot as the hand will bear and applied frequently to the sides afford relief. After fomenting, the sides should be rubbed dry and some mild embrocation such as soap liniment, should be rubbed in to prevent chilling (*see* Formulæ 72 and 73).

TRAUMATIC PNEUMONIA.

In this condition the pneumonia is due to the penetration of the lungs from without or to severe blows on the chest or injuries inflicted by a broken rib.

Symptoms.—High temperature, shivering, a small fast pulse, evidence of injury. There is prostration, weakness, at times profuse diarrhœa. The breath owing to gangrene of the lung has as a rule an intolerable stench. This form of pneumonia is generally fatal.

Treatment.—Cleanse the wounds thoroughly and keep them well disinfected. The strength of the animal should be maintained; fluids should not be forced on an animal. If he can be induced to take it, euquinine in drachm doses to reduce temperature may be tried.

CHAPTER XI.

DISEASES OF THE CIRCULATORY SYSTEM.

HEART AND LARGER BLOOD VESSELS.

Diseases of the heart as evidenced by *post-mortem* examinations are much more common than might be supposed. The diagnosis of such during life, however, much less the differentiation of one condition from another, is surrounded by difficulties. The position of the heart, coupled with the extreme suspicion and nervousness displayed by most elephants on the approach of any stranger, renders efforts at examination difficult and unsatisfactory. *Post-mortem* examination sometimes reveals that heart-disease in an advanced stage may exist without being suspected during life.

Symptoms pointing to heart affections are alterations in the character of the pulse, which may be regularly or irregularly intermittent ; *i.e.*, in the former case, a pause or miss of a beat is observed at regular intervals, say after every fifth or tenth beat ; in the latter, the pause occurs at irregular intervals. The pulse may be accelerated and in some instances retarded ; breathlessness (the mucous membranes being of a bluish colour) more apparent when an animal is put to work, or rapid exhaustion, muscular weakness, giddiness or fainting shortly after ; coldness of the extremities, the presence of dropsical swellings about the body, limbs, etc. ; in fact conditions pointing to defective circulation, such as sloughing of portions of the ears and tail, gradually increasing weakness and emaciation, and finally sudden death not attributable to other causes. In elephants death may occur suddenly from long continued and unobserved disease of the heart. It must not be forgotten that functional troubles may give rise to many of these symptoms ; hence careful observation for some time is necessary to avoid as much as possible drawing hasty conclusions and thus making very serious errors, such as disposing of a valuable animal which may be considered useless, and finding later on the symptoms have disappeared and that the animal is working as usual.

Causes.—The chief factor in bringing about disease of the heart and vessels is overstrain from continued or even sudden over-exertion. It is only necessary to see animals working heavy timber in difficult places to estimate the enormous physical exertion required to perform the tasks they do.

The conditions met with *post-mortem* in one case showed atrophy of the organ (wasting of its substance); in several others, hypertrophy (enlarged heart). The heart is in some cases enormously large and may rupture from extreme and sudden exertion or show disease of the valves on both sides. Sometimes rupture of the aorta may occur.

Treatment.—If heart-disease exists, it naturally means that treatment can only be palliative, and that the animal is at least useless for jungle work. The only thing to be done is to give absolute rest, feed carefully and give tonics—iron, nux vomica. If the animal is feeble, alcoholic stimulants. In some cases bicarbonate of soda in $\frac{1}{2}$ -oz. doses may be useful, and afterwards iodide of potash in 3-dr. doses twice a day. At best in the case of elephants we are working in the dark.

RUPTURE OF THE LARGER VESSELS.

In cases of rupture, this is invariably due to some long-standing disease in the walls of the affected vessel rendering it weak; hence a fall or sudden violent exertion such as *ounging* a very heavy log, may cause the vessel to burst. The usual place where the aorta gives way is close to the valves as it leaves the heart from the left ventricle. In these cases the bag of the heart (*pericardial sac*) will be found filled with blood. Enlargement of the heart appears to predispose to rupture of the vessels. Rupture of other large vessels, such as the *vena cavæ*, may occur.

In making a *post-mortem*, if much blood is found in the cavities, careful search should be made for the reason of its appearance there.

Symptoms—Are those of any internal hæmorrhage, blanching of the mucous membranes, feeble or imperceptible pulse, cold extremities, rapidly failing strength, swaying to and fro and finally collapse.

FILARIASIS OR WORMS IN THE BLOOD.

This is an infection of mammals, birds, etc., by various species of the genus *filaria*. The mature *filariæ* are long, slender round worms of uniform breadth, some about the thickness of cotton or fine twine.

Many animals and man are the definite hosts of certain species. The cases of human beings with thick legs (elephantiasis), seen perhaps more commonly in Burma amongst Madrassis, are generally

due to filarial infection, and in these cases certain kinds of mosquitoes have been proved to be the intermediary hosts. The long slender white worms in the heart so commonly occurring among dogs in this province and China, are the *filariæ immitis*. In animals mosquitoes, ticks and lice may be the intermediary hosts, or the worms may be taken ingested direct from infected water. In the elephant, blood examination has on many occasions revealed the presence of embryonic *filariæ* in the peripheral blood. Whether the fully developed *filariæ* are of any significance in connection with any elephant disease remains to be seen. In one case the elephant was the subject of flukes, in two others the animals were emaciated and *surra* was suspected and again they were present in some cases of *surra*. In several cases, however, the infected animals appeared to be in good health.

DISEASES OF THE LIVER.

As is the case in most diseases of the internal organs, their diagnosis is obscure owing to the indefinite and undecided nature of the symptoms. Yet we know from *post-mortem* examination that this organ is frequently the seat of disease. When we observe jaundiced (yellowish) membranes with very high-coloured urine, it is a decided symptom pointing to liver derangement, but the absence of such is no proof that the liver is not the seat of serious mischief.

ICTERUS OR JAUNDICE.

This is not a disease but merely a symptom, and is applied to a condition in which the visible mucous membranes take on a yellowish colour. This is due to the liver being surcharged with bile, which is re-absorbed by that organ and passed into the blood. It is a common symptom in many liver complaints which may arise from a variety of causes.

Causes.—May be due to a chill, infectious diseases, or to indifferant food, flukes.

Symptoms.—Fever, loss of appetite, thirst, often diarrhœa; later the mucous membranes of the eye and eyelids become yellowish or deep citron or orange colour; the mouth and palate in severe cases are markedly yellow and the urine is especially so, being a deep orange or greenish yellow. The animal is sluggish; the mouth is often dry. In intense cases of jaundice the symptoms are usually severe; constipation may be pronounced owing to the absence of

bile in the intestines; the dung is light or clay coloured, and the stench considerable. The animal is weak, very dull and comatose. Death may result in these cases.

Treatment.—All grain should be withheld. Freshly-cut green grass, fruits, etc., given a little at a time and often.

The bowels may be relieved with a dose of—

Aloin	...	...	1 dr.
Calomel	...	...	1 dr.
Aniseed	...	...	$\frac{1}{2}$ oz.

OR

Aloes	...	...	6 drs.
Calomel	...	...	1 dr.

Artificial Carlsbad salts as given by Wallis Hoare may be tried—

Sulphate of soda	...	...	$5\frac{1}{2}$ ozs.
Sulphate of potash	...	...	2 ozs.
Common salt	...	...	$2\frac{1}{2}$ ozs.
Bicarbonate of soda	...	...	$4\frac{1}{2}$ ozs.

Divide into four powders; give one once or twice a day dissolved in drinking water or in a ball followed by a drink.

Epsom salts in 6-oz. doses twice a day till bowels are freely opened.

RUPTURE OF THE LIVER.

This organ is liable to be ruptured when in a state of advanced disease after a severe fall or blow, colic, etc. Those dealing with elephants are aware of the terrific force with which they knock each other about when fighting. Though a *haing* has no tusks, his strength is often so great as to be able to knock a full-grown elephant off his legs if he catches him in the right place. Such violence tends to bring about the rupture of an organ, more especially so when in a state of disease.

Symptoms—Appear quite suddenly and are those of internal hæmorrhage as described under “Rupture of the Spleen.”

DISEASES OF THE SPLEEN

Cannot be diagnosed during life. Changes which occur in the spleen are usually due to secondary processes in the course of some of the infectious fevers, septicæmia, pyæmia, but especially in anthrax, in which disease it may be found enormously enlarged.

The symptoms of disease of the spleen are too obscure to be noted.

RUPTURE OF THE SPLEEN.

The possibility of a rupture of the spleen as the result of a severe blow or fall must not be overlooked. The symptoms in the case of an extensive rent are those of rapid internal hæmorrhage, great paleness of the mucous membranes, rapid loss of strength, coldness of the limbs, ears, etc., weak pulse, a falling body temperature, frightened appearance of the animal, ending in death in a short time.

Death from hæmorrhage also occurs as a result of penetrating wounds of this organ.

Treatment.—Try and control the hæmorrhage. The most useful drugs are extract of ergot in doses of 1 to 2 drachms, acetate of lead 2 drachms, well diluted with treacle and water, and preparations of iron.

NEPHRITIS OR INFLAMMATION OF THE KIDNEYS.

The kidneys like other organs are apt to become inflamed.

Causes.—Chill from exposure to cold and wet; any of the acute fevers, such as anthrax, certain drugs, such as Spanish-fly (cantharides) and turpentine.

Symptoms.—Fever with its usual symptoms noted under that condition; usually increased frequency in voiding water, which act is often accompanied by colicky pain, but the amount of water passed is frequently very small; sometimes it is suppressed. The urine itself is very high-coloured and may be mixed with blood.

Prognosis.—As the function of the kidneys already described is to remove poisonous matters from the blood, it follows that when these organs are diseased these poisons are partially or wholly retained and may produce death, usually accompanied by violent convulsions; hence prognosis is unfavourable.

Treatment: Local.—Frequent hot fomentations by means of rugs wrung out of hot water should be persevered with. Care should be taken to dry the parts after. Clothe the loins or rub in liniment to avoid chill. A mustard plaster, 18 inches square, may be applied over the kidneys. Neither turpentine nor cantharides (Spanish-fly) should on any account be applied as a liniment or blister.

Soap and warm water enemas, to which may be added one ounce of chloral, or extract of belladonna $2\frac{1}{2}$ drachms rubbed down, tend to afford relief when there is much pain.

General.—A liberal allowance of freshly-made gruel—linseed, wheaten or rice, to which jaggery or salt may be added. A tub of fresh clean water kept at the standing. Food should be given

fresh and in small quantities. A purgative of aloes and calomel may be given. Liquor ammonia acetatis in doses of 3 ounces may be added to drinking water, or acetate of potash in 3-dr. doses or bicarbonate of soda in 1-oz. doses twice or three times a day. Care must be taken not to act on the kidneys too much. When the urine is suppressed the case is very serious. During convalescence tonics should be administered.

CYSTITIS OR INFLAMMATION OF THE BLADDER.

This is rare and when it occurs probably indicates some irritation of the bladder due to an abnormal state of the urine.

Causes.—Chill.

Symptoms.—If there is inflammation there will be some fever, straddling of the legs and increased frequency in voiding urine, accompanied by straining; urine turbid.

Treatment: Local.—Hot fomentations to the loins. Warm water enemas. The loins should be protected with a blanket.

General.—Clean and fresh diet, plenty of fresh gruel, bicarbonate or acetate of potash in small doses.

Boric acid is recommended by Wallis Hoare and may be tried in doses of 4 drachms twice daily.

RETENTION OF URINE.

This is a condition characterized by inability to empty the bladder and may be complete or partial.

Causes.—It may be due to nervous disturbance after an accident such as a heavy fall, especially when under a load, the retention being sudden and complete, or to over-distension of the bladder causing paralysis of the muscles; to debility of the walls, and to the presence of growths interfering with the action of the muscle. Obstruction may also be a cause, such as from the presence of a stone, tumours pressing on the bladder and blocking the passage. It also appears as a common complication in paraplegia, excessive accumulation of fæces in the rectum and colic. Partial retention, owing to nervous excitement, is frequently met with in *musth*.

Symptoms.—Pain, restlessness, frequent attempts to pass water, which, after an unusual interval during which no water is passed, dribbles away in drops or a small feeble stream. If the arm is

passed well into the rectum, the bladder may be felt distended (the bladder is situated immediately below the rectum).

Treatment: Local.—Frequent hot fomentations to the loins. Empty the rectum with the hand and throw up soap and warm water enemas, to which chloral hydrate (half an ounce) may be added. Insert the arm and apply gentle pressure to the bladder if that organ is distended.

General.—A brisk purgative, and afterwards linseed or rice gruel *ad lib.*

HÆMATURIA OR BLOODY URINE.

Blood in the urine may arise from three sources, namely : (a) the urethra, (b) the bladder, (c) the kidneys.

If the passage of urine be preceded by the passage of a clot, or if blood be passed involuntarily and independently of the act of staling, it is certain that the source of blood is from the urethra or passage. When the blood is not well mixed with the urine and clots are passed towards the close of the act of staling, we may assume that the blood is from the bladder.

If the blood be from the kidneys it is intimately mixed with the urine, giving it a reddish smoky tint.

It is not an easy matter by ordinary inspection to determine whether blood is from the bladder or kidneys.

Causes.—The common cause of discharge of blood from the urethra is an injury. Blood from the bladder may arise from acute inflammation, stone, ulceration, tumours, etc. In the case of the kidneys, blood may arise as the result of injury, acute inflammation of the organs, stone, parasites, growths. Blood may also follow on the excessive or indiscriminate use of drugs, notably cantharides or turpentine, or after feeding on certain acrid plants.

Treatment.—This depends of necessity on its cause, it being a symptom of several diseases. The bowels must be kept regular ; the patient allowed complete rest ; the diet should be nutritious and moderate in amount. In order to control the bleeding, if very excessive, good results may be expected by the exhibition of such drugs as gallic acid, acetate of lead, alum and some preparations of iron.

Acetate of lead ...	...	...	1 dr.
Gallnuts (powdered) ...	...	...	2 drs.
Jaggery ...	...	...	Sufficiency.

Twice or thrice daily.

OR

Tincture of perchloride of iron (dilute) ...	1 oz. doses.
Water	A sufficiency.

OR

Gallic acid	$\frac{1}{2}$ to 1 dr.
Jaggery	Sufficiency.

Every three hours.

DIABETES.

One form of diabetes is occasionally seen in the elephant, characterized simply by profuse staling.

Causes.—In horses due to bad fodder and also to an undue proportion of saline matters in the water. It may be inferred that such causes may produce profuse staling in the elephant.

Symptoms.—Passage of large quantities of pale watery urine, thirst, and gradually increasing loss of flesh.

Treatment.—Care with regard to food and water, and change to another locality.

The following may be tried :—Iodide of iron in doses of 30 to 40 grains two or three times a day. Opium in doses of 2 drachms twice or thrice daily.

Tonics, especially arsenic, iron and nux vomica, are indicated (*see* Formulæ 39 to 46):

LYMPHANGITIS.

A condition somewhat like this disease in the horse may occasionally be met with in elephants. So far I have only seen it in yard elephants in Rangoon, and also in the elephant in the Zoological gardens which has suffered from two or three attacks. The attack usually occurs after a period of idleness. For no apparent reason a limb, hind or fore, may be found in the morning swollen, the animal being hardly able to place any weight on the affected limb, which is painful, the animal often being lame. There is possibly some fever, but the animals in which the condition was observed were unsafe to handle. In horses the cause is due to some irritation of the lymphatic glands, and the swelling due to materials thrown out into the surrounding connective tissue as a result of the inflamed condition of the lymph glands and vessels.

The condition may also arise from injuries such as wounds about the feet and limbs due to some septic infection.

Treatment.—In all but one case the following treatment was employed with success. The food was reduced in quantity, plenty of good gruel was allowed, a strong dose of physic, aloes and calomel, was administered, which reduced the pain and swelling. Frequent hot fomentations were applied to the limb and afterwards massage by the attendants. For some days the animals were given small doses of epsom salts with nitre twice a day. When the acute symptoms had passed off regular and gentle exercise was allowed.

In one case the limb remained swollen for some time. This animal received regularly doses of arsenic and iodide of potash, and liniment was rubbed in on alternate days. The bowels were kept freely open and in due course he made a good recovery. In the case of the Zoo elephant, during the course of one attack, he developed an abscess on the inside of the limb. This healed in the ordinary way.

In all cases, if the elephant will permit it, careful search should be made for wounds of any sort, and to these if found careful treatment should be applied.

CHAPTER XII.

DISEASES OF THE STOMACH AND INTESTINES.

The dung is passed from eight to twelve times in the twenty-four hours and has the following characters :—

Colour.—When first voided, golden or reddish yellow, becoming varying shades of chocolate brown after some exposure to the air.

Form.—Voided in large lumps.

Consistence.—The masses are moist, but firm enough to remain frequently unbroken after being dropped.

Smell.—The smell is peculiar, but not disagreeable.

Substance.—Varies according to the characters of the food ingested.

Any departure from the above characters may indicate disease of this tract and may be summed up as follows :—Diarrhœa, constipation, colic, loss of appetite, depraved appetite shown by eating dirt, dryness of the mouth or redness, pallor or sores, dung unduly hard or liquid, offensive, unnatural colour, admixture of slime or blood, or passage of worms.

INDIGESTION.

Definition.—By the term indigestion we understand that the digestive system is deranged. It may be acute or chronic.

ACUTE INDIGESTION.

Causes.—Irregularities of the teeth interfering with proper mastication of the food, coarse dry indigestible fodder, unsuitable food, long fasts, damaged grain, overloading the stomach with an excessive quantity of food. I have known a heavy feed of grain off a threshing floor to cause a severe attack.

Symptoms.—Drowsiness, disinclination to work, loss of appetite, constipation, sometimes acute abdominal pain.

Treatment.—Should be prompt. A smart purge of castor oil one pint, with croton oil 25 to 30 drops, to which may be added half an ounce of tincture of opium if pain is severe, and the resulting

constipation treated by enemata or laxatives, or a dose of aloes and calomel. Starvation for some hours, after which nothing but gruel for twenty-four hours should be given, when if the dung is natural, ordinary food may be allowed in small quantities and gradually increased, carefully watching the excretions. In cases of disorders of the stomach and intestines and also in debility, molassine meal is worthy of a trial.

CHRONIC INDIGESTION.

Causes.—An acute attack which has remained uncured, want of change of diet, highly stimulating food such as the free use of *mussauls*, insufficient exercise, liver disease, intestinal parasites. In young animals too early removal from the dam, or compelling the dam to work shortly after the birth of the offspring, or allowing the calf to suckle when the mother is heated, or at long or irregular intervals. It is most usually met with in very young or very old and debilitated animals.

Symptoms.—The animal is dull, appetite poor, thirst great, the skin harsh and dry; if worked, he is sluggish; the membranes of the mouth pale or yellowish in colour; if the hand is placed in the mouth, it will be found to be sticky. The condition of the bowels vary: in some cases they are constipated and the dung is passed in small quantities accompanied by a good deal of flatus, the *fæces* being hard and dry and consisting mostly of unaltered fibre, or the bowels may be relaxed, not always diarrhoea, but the evacuations soft, and a quantity of fluid may be passed at the same time. If the dung is examined, a good deal of grain may be found in an unaltered state, clearly proving that digestion is not being properly performed, or that the food itself is unsuitable and indigestible. The dung often possesses a sour nasty smell, and varies in colour; it may be nearly black, clay blue, or of a peculiar greenish yellow. Animals suffering from indigestion often have a tendency to eat earth.

Treatment.—The teeth should be examined for irregularities and the mouth for sores. The evacuations must be carefully examined, as also the food and water-supply. A change of food should be tried and an extra quantity of salt allowed. If the bowels are constipated, a mild dose of physic should be given, such as epsom salts, small doses of aloes and calomel repeated, or laxative powders such as sulphate of soda 2 ounces, bicarbonate of soda 3 drachms, common salt 3 ounces twice a day, or better still, enemata (Formulæ 77 to 80). When diarrhoea is present, unless severe, it

should not be checked, as the bowels may thus be relieved of some irritating matter. They must be kept regular by gentle laxatives, or enemata and exercise. To restore tone to the digestive organs vegetable and mineral tonics are indicated, such as the following:—

No. 1.

Nux vomica	...	...	1 to 2 drs.
Bicarbonate of soda	...	...	3 drs.
Chiretta, ginger, gentian or aniseed	...	...	1 oz.

Once or twice daily after food.

No. 2.

Arsenic	...	...	2 to 3 grs.
Bicarbonate of soda	...	...	4 drs.
Ginger or gentian	...	...	1 oz.

Once or twice daily for ten days after food.

No. 3.

Powdered nux vomica	...	...	1½ drs.
Powdered sulphate of iron	...	...	2 drs.
Powdered chiretta, ginger or aniseed	...	...	1 oz.

Mix and give for one dose twice a day.

No. 4.

Fenugreek	...	...	12 ozs.
Aniseed	...	...	6 ozs.
Carbonate of iron	...	...	2 ozs.
Black pepper	...	...	4 ozs.
Ginger	...	...	4 ozs.

To be reduced to powder and well mixed.

Two ounces for a dose twice daily.

No. 5.

Aniseed	...	...	½ oz.
Gentian	...	...	½ oz.
Black pepper	...	...	2 drs.
Green ginger	...	...	½ oz.
Black salt	...	...	1 oz.
Jaggery	...	...	Sufficiency.

Once or twice a day.

(See also Formulæ 11 to 14.)

Above all strict attention to diet which should be good, clean and nutritious; grain should be withheld for a time. Work should be stopped and, when possible, the animal given a change to some grazing where he can choose his fodder and obtain some exercise.

DIARRHŒA.

Definition.—A condition characterized by increased frequency in voiding dung, which may be merely softer than normal, or in severer forms quite liquid, and may be accompanied by griping pains. Diarrhœa should be regarded as a symptom and not a disease *per se*.

In the elephant we may for convenience divide diarrhœa into three forms, namely,—

(a) Ordinary. (b) Nervous. (c) Parasitic.

(a) *Ordinary: Causes.*—A variety of causes tend to produce this condition which are chiefly dietetic and may arise from the quality or quantity of food.

Diet—(a) *Quality.*—Coarse, indigestible and innutritious, or succulent, rank, rapid-growing grasses and sedges such as appear during the early rains, or poisonous plants, damaged or diseased grain. When grain, flour, etc., are damaged by wet or other cause and condemned as unfit for human consumption, it is by no means unusual for some one to propose that it had better be given to elephants or other animals; if such food is likely to prove baneful to the health of men, it is equally likely to provoke illness amongst animals.

(b) *Quantity.*—An excess of food, especially in petted and pampered animals and those obtaining free access to large quantities of grain.

Poisons.—Administered wilfully or accidentally, may occasionally be a cause.

Liver disease.—By producing an excessive flow of bile.

Exposure.—To cold and wet.

Water.—Drinking very cold water or bathing in it when the animal is heated. Water in certain localities charged with saline salts may induce an attack.

Diarrhœa is also often a symptom in specific fevers and is moreover a frequent sequel to constipation, masses of dung collected in the lower bowel causing irritation with increased secretion from the bowels; or it may depend on disorders of the stomach or bowels.

Treatment: Preventive.—Lies in ordinary attention to the diet, water, shelter. The cause of the attack must be sought for and removed.

Curative: Local.—In severe cases enemas should be employed in conjunction with other methods; these must be small in bulk in order that they may be retained (a few quarts), and the most beneficial are 2 or 3 ounces of tincture of opium added to 3 or 4 quarts of thin starch gruel.

General.—Try to ascertain the cause and if found remove. In a great many cases diarrhœa is merely an effort of nature to throw off some offending irritant from the bowels; it is therefore clear that in such instances our efforts should be to encourage it with caution; solid food must be withheld, especially grain, but a liberal allowance of rice, flour, barley, or arrowroot gruel sweetened with a little sugar should be allowed. These tend to soothe the irritated state of the bowels. Bael fruit when in season is a valuable adjunct to other forms of treatment, as also are bamboo leaves. Drinking water, which should be given in tubs, should in the cold weather have the chill taken off and be allowed in moderation. In severe attacks stimulants, such as rum, brandy, whisky, should be given in addition to astringents (Formulæ 7 to 10, also *see mussauls*). Perfect quietude is essential and good shelter (a tarpaulin or rug covering when cold) and a dry standing. When due to errors in diet, castor oil, one pint or a pint and a quarter, is the best agent for removing the irritation. In bilious diarrhœa, when the dung is of a bluish green colour, liver medicines should be administered (Formulæ 35 and 36).

Diarrhœa is at times very violent and requires drugs to aid the above (Formulæ 7 to 10). When the dung is foetid, sulphite or hyposulphite of soda in 3-oz. doses may be given with advantage either in drink or in bolus. When once improvement sets in, care must be taken to allow only small quantities of good clean fodder, gradually increasing this till the full ration is attained, but always being guided by the condition of the dung. The animal should be given gentle exercise, but not permitted to resume work for some days after the attack has subsided. This, of course, refers to severe cases. Enemas are also most useful (Formulæ 82 to 84).

(b) *Nervous diarrhœa.*—This may be seen in fretful nervous animals. Any one acquainted with elephants or monkeys is aware how suspicion, fear, or excitement may suddenly produce an attack of diarrhœa. The cause being removed, it passes off almost as suddenly as it has appeared; hence treatment is not required.

(c) *Parasitic diarrhœa.*—Is described under parasites and no further mention is needed here.

Diarrhœa in calves.—Especially those of new captures is not infrequent. Owing to fear and excitement consequent on capture, the milk of the dams perhaps becomes altered in character, rendering it difficult of digestion. Again under such circumstances some of the cows appear to secrete milk irregularly, that is, there is more milk in the udder at one time than another; consequently the calves may get a good supply of milk at one meal and very little at another; this invariably means indigestion, which often results in severe

diarrhœa. Calves subjected to such treatment present the following appearance :—They are usually out of condition, the skin is dry, often shiny and scaly-looking and adheres to the underlying structures ; in other words, exactly the condition known among horses as “hide-bound” ; the animals are dull and listless, thirsty, the mouth dry, the appetite capricious.

Treatment.—It is most difficult to handle some young elephants. They at times get very hasty in temper, make a terrific noise upsetting the cows that may be in camp. If they are being hand-fed, attempts to administer drugs cause them to refuse food. If milk is procurable it should be given and citrate of soda, two grains to the ounce of milk, added ; milk so treated forms a curd in the stomach which is easily digested. Later on rice well boiled or better still broken rice may be added to the milk with sugar or a little salt. Molassine meal may also be given.

A mild dose of medicine may be given, such as 4 ounces of castor oil beaten up with 2 drachms of bicarbonate of soda. If pain is severe small doses of tincture of opium may afford relief.

SUPER-PURGATION.

Causes.—Excessive purgation, due to an overdose of purgative medicine, to undue action of an ordinary dose, or to repetition of a dose at too short an interval, or working an animal too soon after he has been given physic.

Symptoms.—Severe gripes, restlessness, weakness, watery evacuations, the animal refuses food, and the pulse soon becomes feeble.

Treatment : Preventive.—When circumstances permit, before giving physic, any grain ration allowed should be stopped 24 or even 48 hours beforehand, and for some 24 hours previous the ordinary diet should be reduced ; by so doing it will be found that less medicine will be required and that it operates better. Care must always be exercised, some animals being easily and violently purged. The state of the animal's health must be inquired into, whether he is at full work and on full feed, whether he has been on green or dry food, such as straw, boughs of trees, also the usual state of the bowels. It is usual and a good practice to combine the physic with some carminative, such as ginger, aniseed, gentian, cardamoms (Formulæ 11 to 15). In some animals, even though every precaution is taken, violent purging may ensue. Large quantities of drinking water must not be allowed after the physic is given, though the animal should be permitted to take sufficient to allay thirst. If the

water be very cold, the chill should be taken off. The animal should not be bathed till the effects of the physic have passed off. It often takes from 16 to 24 hours for the physic to operate, and its action continues for from 4 to 12 hours at intervals. If a purgative "hangs fire," a little walking exercise, or a soap-and-water enema, will hasten its action. Debilitated and otherwise delicate animals should only receive mild purgatives. Diet should be restricted while the animal is undergoing physic. Gruel in moderate quantity only is to be allowed. The animal should be kept quiet and the body clothed.

Curative—

No. 1.

* Opium	...	...	3 drs.
Ginger	...	...	$\frac{3}{4}$ oz.
Caraway seed	...	...	$\frac{1}{2}$ oz.
Jaggery	...	...	A sufficiency.

Every four hours till relieved.

No. 2.

Tincture of opium	...	3 ozs.
Sweet spirits of nitre	...	3 ozs.
Aromatic spirits of ammonia	...	$1\frac{1}{2}$ ozs.

Soaked in bread, mixed with boiled rice and given in straw packets.

OR

No. 3.

* Opium	...	3 drs.
Chalk	...	2 to 3 ozs.
Catechu	...	2 ozs.

Twice daily.

(Also *see* Formulæ 1 to 10 and 82 to 84.)

Alcoholic stimulants, such as brandy, rum, whisky, given in gruel. Ordinary lime-water mixed with gruel often proves beneficial.

DYSENTERY.

This condition is uncommon and is manifested by intermittent griping pain accompanied by discharge of liquid dung mixed with blood and slime.

* Ganja (Indian hemp) in doses of 3 to 4 drachms may be substituted for the opium.

Causes.—Generally due to chill, but may be a sequel of diarrhœa, indifferent food and water.

Symptoms.—Fever may or may not be present ; abdominal pain most noticeable during the act of voiding the dung, which act may be accompanied by severe straining. The matter passed is liquid, often foul-smelling, and contains either blood or slime or both.

Prognosis.—Favourable under early and careful treatment.

Treatment.—As already noted under diarrhœa, to which may be added freshly powdered cinnamon in 1-oz. doses, and enemas containing boracic acid 5 ounces to 4 pints of boiling water, which must be allowed to cool before use ; a couple of quarts of this should be injected two or three times a day or oftener.

Solid food should be withheld until there is an improvement.

CONSTIPATION.

Like diarrhœa this is to be regarded as a symptom rather than as a disease. It is applied to a condition of the bowels in which the dung is unduly hard, and not as is often supposed total inaction of the bowels.

Causes.—It is a usual concomitant of fever and may be induced in a variety of ways ; the quality of the diet, such as an undue proportion of dry fodder including grain ; the astringent properties of the barks of many trees which they eat ; certain astringent drugs ; inactivity of the liver inducing a lack in the secretion of bile ; habitual excessive food and insufficient exercise are among the more common causes.

Symptoms.—Are seen in the character of the dung, which may vary from slight undue dryness of its substance, causing some difficulty in evacuating it, to a complete blocking of the alimentary canal, no dung escaping at all. In addition to being hard it may be darker coloured and often offensive ; the animal usually has a dry mouth and at times is very thirsty and generally drowsy.

Treatment : Preventive.—Consists in avoiding the causes enumerated above.

Curative : Local.—Enemas (Formulæ 77 to 80).

General.—Consists of internal medication (Formulæ 23 to 28, and also 40).

When constipation is present in the course of acute fevers, purgatives should be withheld, but small doses of epsom salts 3 to 4 ounces may be given twice daily : this will be taken if well diluted when the animal is thirsty.

INTESTINAL OBSTRUCTION OR STOPPAGE OF THE BOWELS.

Causes.—Collection of food and blocking of the bowel, or a twist of the gut.

When elephants are left entirely to their keepers it is not uncommon for them to feed the animals entirely on branches of trees, being too lazy to cut grass for them. Some barks are very astringent and contain a large amount of woody fibre with a small amount of sap, which is difficult to pass along the bowel, and tends to collect and eventually produce stoppage.

A surfeit of grain, especially in animals not usually allowed any, may also provoke this condition.

Symptoms.—Restlessness, off feed, distended abdomen, severe continued pain, marked constipation, often a total absence of passage of wind or dung. If not quickly relieved, the symptoms become aggravated, distension and pain grow worse, severe fever sets in and death may ensue rapidly.

Treatment.—Avoid purgatives which will only aggravate the condition, also sedatives like opium, ganja, etc. The following may be tried, namely, extract of belladonna 2 drachms mixed with jaggery. This may be repeated in four or five hours, or oil of turpentine 4 ounces beaten up with some bicarbonate of soda, 3 ounces of aromatic spirits of ammonia in a pint of linseed oil. Some aromatic such as a few drops of oil of aniseed may be added to mask the taste. Powdered nux vomica in a full dose is recommended up to one ounce. In less acute cases enemas are most beneficial. The rectum should be emptied by hand, after which copious enemas of soap and hot water (at a temperature which will bear the hand comfortably) to which 2 to 3 ounces of oil of turpentine is added should be thrown up, and repeated without the turpentine every hour or so till relieved. If the obstruction is relieved, every care with regard to food must be observed as laid down under "Severe diarrhœa."

Cases of intestinal obstruction are always difficult to diagnose, and are only too often fatal. Twist of the bowel and intussusception, *i.e.*, a portion of the gut having become telescoped within the succeeding portion, have been observed. The following extract records a case of the latter :—

INTUSSUSCEPTION IN AN ELEPHANT.

"The patient, a male elephant, aged five years, was a passenger on board the s.s. *Pegu*, which left Rangoon for Liverpool on March 29, 1903.

" He remained quite well during the first five days of the voyage. He then began to show signs of illness. He refused food and assumed a sullen disposition. There was no movement of the bowels and no vomiting. A brother passenger to the patient, taking similar diet, was enjoying his customary good health.

" On the following day the condition of the patient became worse ; he groaned loudly and seemed to be in much pain. He then lay down upon the deck, the eyes lost their lustre, the lids dropped, and he seemed oblivious of all. A low, monotonous whine indicated that our patient was still suffering, while the lateral decubitus which he had adopted showed that his general condition was serious—for, as is well known, an elephant in health rarely, if ever, lies down, and he even sleeps standing.

" As nothing but a little blood-stained mucus was passed per rectum, an enema was administered, olei ricini, O j. Most of this was retained, but it gave no result. A second dose of castor oil was then given per oram, and was followed by a small fluid motion with mucus and a few round worms $\frac{1}{2}$ to 1 in. in diameter—probably the normal denizens of the bowel. The rectal mucosa was slightly prolapsed, no doubt as a result of the excessive straining. A rectal examination, *the whole arm being introduced*, revealed no obstruction.

" To allay the pain with which the patient seemed now to be suffering much, a dose of morphia was given by the bowel: liq. morph. hydrochl., drs. x. ; aquam. ad O j. Not more than half of this was retained.

" Following this the patient was quieter, but as he seemed to be sinking a stimulant was given: spiritus vini gallici, O j. ; aquam, ad C ss. He did not rally, however, and death followed shortly after.

" *Post-mortem.*—The abdomen was opened by an incision in the mid-line. The abdominal wall was extremely tough, and about 1 in. in thickness, although singularly devoid of fat. The intestines bulged out from the wound, they were much distended.

" After removing the main portion an intussusception was found a few yards from the anus. It formed a tense cylindrical mass about 3 ft. in length and quite a foot in diameter.

" On opening the intussusception the walls of the gut were found to be swollen with œdema to a thickness of 2 in. Above the intussusception was a large mass of fæces about the size of a cocoanut. This was soft and friable, and, therefore, presumably not the cause of the condition.

" In looking back upon the case, the possibility of operating occurs to one. But having regard to the difficulty in finding the

intussusception, owing to the large size and great distension of the intestines, and the impossibility of reducing it without using the knife, it seems that the chances of preventing a fatal result would have been almost *nil*."—"Charing Cross Hospital Gazette."

COLIC.

Colic is a term applied to pain in the abdomen, commonly called gripes, or belly-ache. Two forms are generally recognized, namely spasmodic colic and flatulent colic. The first is due to a spasmodic contraction of the muscular coat of the bowel; the second is caused by the intestine being distended with gas, due to the fermentation of food.

Colic sometimes is only a symptom of grave trouble to follow.

Causes.—The most frequent cause of colic is the presence of some irritant in the intestinal tract. Overfeeding and underworking animals predisposes them to attacks of colic, as they take in more nourishment than the system can assimilate. The accumulation of fibrous material when elephants are fed on branches of trees. Animals in poor condition are often the subjects of colic, which is due to want of tone in the digestive system. Eating large quantities of earth at times causes it; in such cases the bowels are often infested with worms. During the early rains colic is not uncommon, as elephants eat large quantities of rank, rapid-growing fodder, which at the period is unwholesome, as it contains very little nourishment and has a tendency to ferment. Dirty and unwholesome grain or fodder causing indigestion may induce colic. Drinking a large quantity of cold water when the body is heated, and permitting an animal to drink too freely when fatigued by a long journey also act as causes. Tethered animals exposed to cold and wet may be attacked.

Symptoms.—Restlessness, swaying from side to side, moving the legs about, standing in different positions, beating the sides with the tail or trunk, yawning, inserting the trunk in the mouth and grinding the teeth. The animal ceases to feed; lies down frequently, but only for a very short time. The pain is intermittent, that is it occurs in paroxysms and is at times so intense that the patient groans, sinks quietly down very suddenly, lies on his side or back kicking, only to get up almost as quickly as he went down. There is no fever. In some cases diarrhoea is present, especially in those where overfeeding, worms, are the cause; in other cases the bowels are constipated. As a rule urine is not passed.

Treatment.—Copious enemata of soap and warm water (also *see* Formula 81) fomentations to the belly, to which turpentine may be added. When severe, fomentations are out of the question, mustard mixed with warm water should be applied, or liniment rubbed over the belly.

Opium	...	...	...	} 4 drs. of each.
Powdered nutmeg	...	...	...	
Aniseed	...	...	...	
Rum	...	...	...	8 ozs.
Jaggery	...	...	...	A sufficiency.

Repeat in four hours if necessary, reducing the opium to $2\frac{1}{2}$ drs.

OR

Opium	...	...	...	4 drs.
Ginger	...	...	...	1 oz.
Jaggery	...	...	...	3 ozs.

Repeated in four hours if necessary.

OR

Chloral hydrate	...	...	$1\frac{1}{2}$ ozs.	} in gruel.
Aniseed	...	...	1 oz.	

OR

Tincture of opium	...	...	3 ozs.
Sweet spirits of nitre	...	...	3 ozs.

Soaked in bread, or mixed with boiled rice, repeated if necessary in four hours.

Ganja in doses of 3 to 4 drachms may be substituted for the opium. (Also *see* Formulæ 1 to 6 and *mussauls*.)

When the acute symptoms have subsided, earlier if possible, it is advisable to give a dose of physic such as castor-oil, to relieve the bowels.

Solid food should be withheld for 24 hours and only good gruel allowed. If attacks recur care should be taken to examine food and water-supply.

FLATULENT COLIC.

Symptoms.—In this form there are colicky pains, but as a rule they are not so acute as in the spasmodic form. The belly may be greatly distended; the bowels are generally constipated; the dung may be dry and hard, or soft and pale in colour; there is loss of appetite, dulness and listlessness; trunk contracted. Severe cases are very serious as death may result. Flatulent colic may also be a symptom of other serious abdominal affections.

Treatment.—Similar to spasmodic colic, only that assafœtida in doses from $\frac{1}{2}$ to 2 ounces, and ginger 1 ounce, may be combined with opium in lieu of other drugs; or hyposulphite of soda in from 1 to 3-oz. doses mixed in a bucket of gruel or water may be given every hour or two.

The bowels should be relieved by enemæ (Formulæ 80 and 81) and when the attack has subsided a purgative should be given. In all cases of colic attention must be paid to the water and fodder, and if either be found indifferent the animal should be removed to other pasture. After an attack of colic food should be given sparingly for a few days and gruel only the day following the attack. Tonics, nux vomica, iron, etc., may be given with advantage to restore tone to the intestines.

If colic be not relieved early, the case may end fatally. Steel records entanglement of the bowels as a cause of death. This is usually brought about by the violent manner in which the animal throws himself about when in acute pain.

ENTERITIS OR INFLAMMATION OF THE BOWELS.

Causes.—Obstruction, severe constipation, neglected diarrhœa, parasites, action of acrid plants or drugs, chills, etc. It is said to be not infrequent in the hot season if elephants are fed largely on the leaves and branches of the peepul, *nyaung-bin* (*Ficus religiosa*).

Symptoms.—During the early stages some constipation and passing of mucus or slime, later on diarrhœa with slime, belly-pains which differ from ordinary colic in that the pain is continuous and increases in intensity as the diseased condition of the bowel advances. Distension of the abdomen is often a marked symptom. Fever is always present, which at once distinguishes it from colic. The respiration is quickened and the pulse very hard.

Prognosis.—Unfavourable, frequently fatal.

Treatment: Preventive.—Consists in attention to avoiding causes noted above.

Curative: Local.—For the relief of pain as described under that condition, *i.e.*, fomentation, turpentine stupes, mustard plasters. Occasional enemæ of warm water may afford relief. Diarrhœa as described under that condition.

General.—Opium in 2-dr. doses every two hours till 8 or 10 drachms has been administered; it not only relieves the pain, but keeps the bowels quiet, an important matter in this malady. Chloral hydrate 4 drachms combined with the opium is more efficacious. Ganja is perhaps more useful than either. Messrs. Parke

Davis & Co. prepare a most reliable fluid extract, and of this 6 to 8 drachms may be given, repeated as necessary. Plenty of linseed gruel should be allowed, also stimulants. Purgatives must on no account be given. If the animal recovers, bring him gradually on to his full ration. No harm will be done by keeping him short till he has quite recovered.

PERITONITIS.

Inflammation of the glistening membrane which lines the abdominal cavity and is reflected over the bowels, etc.

Causes.—It may occur as an independent disease, due to exposure to wet and cold, or resulting from inflammation or obstruction of the bowels, but more commonly in elephants it is caused by punctured wounds of the abdomen, the result of goring, or falling on sharp stakes (septic peritonitis).

Symptoms.—Very similar to those of obstruction just mentioned; high fever is an early sign.

Prognosis.—Unfavourable, usually running a rapid and fatal course.

Treatment—Must be according to the symptoms and consists in relieving pain as laid down under that condition. As the bowels require perfect rest, enemas must not be used and food must be given in the form of gruels only. Stimulants such as brandy, rum, may be administered at intervals. Wounds must be carefully treated as laid down under "Punctured wounds" (see page 181).

VOMITING AND CHOKING.

Though emetics appear to have no action on the elephant, vomiting in a severe form is occasionally met with. Gilchrist and Hawkes describe the condition, the cause being ascribed to washing an animal immediately after coming off a journey when much heated. In two cases of hæmorrhagic septicæmia vomiting of green matter at intervals was observed.

Symptoms.—An elephant, apparently quite well, suddenly commences to vomit freely; great irritability of the stomach is manifested by the animal being unable to retain liquids or solids for some hours after the commencement of the attack. When the irritability subsides, the animal will take food, but after swallowing the pellet it may become impacted in the gullet and soon after even the power of swallowing is lost. A lump may sometimes be felt in the

neck indicating the seat of the impaction. There is great distress and the condition is accompanied by hiccough. It may occur at any season of the year.

Prognosis.—Unfavourable unless relief is promptly afforded; death ensues in from three to four days. For some hours previous to death the surface of the body is extremely cold.

Treatment.—All solid food should be withheld until the animal is well over the attack, after which small quantities may be given sparingly care being taken to watch for any symptoms of difficulty in swallowing; plenty of well-boiled rice or gruel may be given after the acute symptoms have subsided.

To try and allay the vomiting, the following may prove beneficial:—

Subnitrate of bismuth	...	...	4 drs.
Bicarbonate of soda	...	...	4 drs.

Mix with honey; a little should be rubbed into the mouth every half hour.

Extract of belladonna 2 drachms rubbed down in glycerine and mixed with a few ounces of treacle may be given in a similar manner.

If the animal can drink, half an ounce of bicarbonate of soda may be added to a bucket of water and repeated in a few hours.

Should an obstruction be observed in the neck, the hands must be well oiled and the swelling gently massaged or manipulated from above downwards in the hope of facilitating its onward progress. When the animal is better, enemas may be employed to relieve the bowels and several days' rest allowed.

On *post-mortem* examination the gullet is usually found in a state of mortification in the region of the impaction; in some cases it was found impacted throughout its extent and in two cases the other organs of the body were in a healthy condition (see Appendix G).

POISONING.

As is well known, Kachins, Karens and other hill tribes are in the habit of using the bark of certain creepers, chiefly *hôn* (ထုနီ, *Coculus indicus*), *Gôn-nyin* (ဂုနီညင်း, *Entada scandens*) and *Mahaga* (မာကာကာ) for stupefying fishes. It has been suggested on more than one occasion that elephants drinking water from pools where fishing operations have been carried on may be poisoned. This I consider is highly improbable, as from what I have seen the majority of fishes are merely stupefied and come to the surface where

they are picked up. If these creepers were poisonous to men and animals the people would be more careful about polluting water not far from villages.

Steel records some very interesting cases of wholesale poisoning of elephants in India by means of the poisonous Nepaul root called *darka* (Aconite?) being given in balls of grain or other delicacies, of which these animals are fond. In this province I have never heard of tame or wild elephants being intentionally poisoned. We must nevertheless be on our guard as such a thing is possible. Many poisonous drugs are administered by mahouts in the treatment of elephants; an overdose might be given through ignorance or carelessness, or by accident. Elephants are very particular as regards the selection of their food; still a case of poisoning might occur. In two cases where animals died rather suddenly, arsenic was detected in the contents of the stomach by the Chemical Examiner. I have little doubt that these animals were being treated by the mahouts with bazaar arsenic, which is often very impure.

The symptoms manifested which might lead us to suspect poisoning are that they occur suddenly, generally while an elephant is in perfect health. As a rule, they arise soon after food has been taken or medicine administered. If more than one animal is taken ill after food or medicine and all suffer from similar symptoms, poisoning may reasonably be suspected.

The poisons we might have to deal with are those employed in treatment, such as arsenic, opium, belladonna, croton beans or croton oil, ganja, dhatura, nux vomica, metallic salts.

For the treatment of poisons antidotes are administered; they act in two ways, either by mechanically preventing the action of the poison or counteracting its effect.

Poisons and their Antidotes.

POISONS.		ANTIDOTES.
Arsenic	...	Preparations of magnesia.
Aconite	...	Tannic acid, and animal charcoal.
Opium	...	Dashing cold water over the body, stimulants; endeavour to keep the animal moving about. Permanganate of potash.
Belladonna	...	Keep the animal moving about; give lime-water and stimulants; dash cold water over the body.
Croton beans or oil	...	Demulcent drinks; stimulants, and opium to relieve pain and check the purging.
Ganja	...	Stimulants; keep the animal moving about.

POISONS.		ANTIDOTES.
Nux vomica or strychnia	...	Bromide of potassium; weak decoction of tobacco.
Tobacco	...	Warm stimulants, tannic acid, and small doses of strychnia.
Metallic salts	...	Steel states that "the formation of tumours over the body, progressive anæmia and even disorders of the feet have been attributed to the empirical use of the compounds of mercury in too large quantities."
		Plenty of white of eggs, wheaten flour conjee, and other demulcent drinks.
Acids	...	Alkalies, such as carbonate or bicarbonate of soda or potash.
Carbolic acid	...	White of eggs, demulcent drinks, stimulants.

The dose of poison may be so large that treatment is of little avail. Antidotes are not always procurable in time to be of service; again the elephant is, especially when in pain, an awkward animal to give drugs to, and such things as inhalation of ammonia are impossible.

If a death occurs under suspicious circumstances, a *post-mortem* should be held, notes taken, and some of the contents of the stomach and commencement of the small intestine, small piece of liver and kidney should be placed in clean jars with some spirit, sealed with a private seal by some responsible person and despatched without delay to the Chemical Examiner, who will readily aid and give his opinion on the case.

MOOKUNDA

Is an affection described by various authors as a result of permitting an elephant to have his ration of rice during the period he is eating earth as a remedy for worms.

Symptoms.—Swelling of the abdomen accompanied by pain and restlessness; the animal appears dull and listless; the surface of the body is cold. There is no diarrhœa.

Treatment.—Bowels to be kept regular with mild laxatives. Diet should be fresh green fodder and gruel. All grain should be withheld. Later, tonics especially preparations of arsenic and iron may be tried.

CHAPTER XIII.

DISEASES AFFECTING THE BRAIN AND NERVOUS SYSTEM.

INFLAMMATION OF THE LINING MEMBRANE OF THE CAVITIES IN THE BONES OF THE SKULL.

Causes.—Prolonged exposure to the sun, injuries to the forehead and bullet wounds. Steel remarks that it may be due to the extension of inflammation in consequence of the intimate vascular connection through the bones between the skin on the forehead and this lining membrane. Gilchrist gives as causes the exhibition of stimulating *mussauls* to elephants who work much in the sun, and to sudden cooling of the body by taking a heated animal into water.

Symptoms.—These are not very evident, but the history of the case will assist. The skin on the forehead may become sore and ulcerated and later the bone may become diseased; there may be considerable excitement and delirium.

Treatment.—Keep in a cool quiet place. Fetter carefully, give a dose of physic. If the head be injured, fomentations may be applied; the wounds should be kept clean and dressed regularly; should matter form, it must be given exit. In the cases resulting from exposure to the sun, cold cloths frequently applied may afford much relief. Cooling medicines, such as tamarind pulp, epsom salts, may be given with advantage. Green food should be given in moderate quantities.

CONGESTION OF THE BRAIN AND ITS MEMBRANES.

The brain and the membranes covering it are intimately connected, and it is a difficult matter to distinguish between congestion of either separately; hence it is best to consider them together.

Causes.—The more common causes of congestion are prolonged work, fatigue and exposure in the sun, extension of inflammation from the membranes lining the air cavities in the bones of the head, acute indigestion the result of high feeding, insufficient exercise, and frequent use of stimulating *mussauls*.

Symptoms.—Fever with its attendant signs noted under that condition. The animal appears stupid and sleepy or giddy, and may

stagger in his walk. In the later stages other symptoms may become pronounced, notably excitement. The animal may become violent and then fall down in a fit of convulsions; after several fits and much struggling the animal becomes comatose and death follows.

Treatment.—Owing to the violence and risks entailed in approaching animals in this state, treatment is dangerous; if it can be managed, a smart dose of physic, such as croton oil, should be administered. When possible, constant application of crushed ice or cold water to the head is most beneficial. In mild cases chloral and bromide of potash may be tried.

Plenty of gruel or fresh water should be kept near the standing, to which a little nitre (4 to 6 drachms) may be added.

APOPLEXY OF THE BRAIN.

A condition characterized by a sudden loss of motion and consciousness.

Causes.—Rupture of a blood-vessel of the brain, resulting in the escape of blood upon or within that organ. In old animals degeneration of the vessels may predispose to rupture, which may be actually brought about by violent or prolonged exertion. Apoplexy may occur during a severe attack of congestion of the brain.

Symptoms.—There may be no symptoms; the animal suddenly drops and becomes comatose.

Death results from the effects of pressure on the brain from the initial quantity of escaped blood, or from a fresh hæmorrhage. Some cases recover, but it is a slow process and not infrequently some form of paralysis supervenes.

Treatment.—Cold to the head; bleeding (*see* page 171). Should the animal recover, care must be taken not to expose him. Stimulating *mussauls* or stimulants should on no account be given.

PARAPLEGIA.

Paralysis of the posterior portion of the body, though common enough amongst mules and ponies under the name of *kumree*, "windstroke," "gone in the loins," is distinctly rare among elephants. It is met with, however, in some cases of infectious fevers and as a result of a severe chill.

Causes.—Altered conditions of the blood as in anthrax and kindred fevers, cold and wet, injuries to the spine by falls.

Symptoms.—A difficulty of movement, swaying and dragging of the hind-quarters and loss of power in them. The animal may fall and if he does is often unable to rise again.

Treatment.—Give a smart dose of physic; fomentations to the loins to which extract belladonna or ganja may be added should be applied. Blistering the loins (*see* Formulæ 54 to 56). Belladonna internally 2 drachms twice a day, and later tonics, such as nux vomica and iron, arsenic (*see* Formulæ 39 to 46). Iodide of potassium, 2 drachms twice a day, may in time bring about recovery. The rectum should be emptied by hand when necessary.

REFLEX PARALYSIS

Is a similar condition to the last, but brought about by causes not affecting the spine directly, but indirectly through nerves connecting it with remote parts. Severe constipation, worms and indigestion may produce this condition, which is usually trifling and amenable to treatment directed to the removal of its cause. Should the condition not be better in a week or so, advantage may be derived from the application of a blister to the loins and its subsequent repetition if necessary. Tonics, especially nux vomica and arsenic, are useful.

PARALYSIS OF THE TRUNK.

Loss of power in this important organ must necessarily lead to starvation, unless special means are taken to ensure the affected animal being hand-fed, and also that he be taken to water deep enough to enable him to drink with his mouth.

Causes.—Paralysis may be met with in cases of advanced debility, or come on as a complication of sunstroke or apoplexy. It is clear that the most humane way of dealing with such a case is to destroy the animal.

Treatment.—If it is decided to treat the case, it will be necessary to see that the animal receives ample nourishment and tonics, such as nux vomica, arsenic, sulphate of iron (Formulæ 39 to 46).

PARALYSIS OF THE FLAP OF THE EARS.

Causes.—Seen in some cases of advanced debility.

Symptoms.—The ears droop downwards and forwards and are immobile.

Treatment.—As in the last.

SUNSTROKE.

This term is applied to a condition usually brought about by exposure to great heat and glare.

Sunstroke in the elephant may be divided as follows :—

- (a) Heat exhaustion, due to the direct action of the rays of the sun upon the brain ; and
- (b) Heat stroke, or heat apoplexy.

HEAT EXHAUSTION.

Causes.—Cases of heat exhaustion are of frequent occurrence, the usual cause being over-exertion in great heat. These creatures, by nature nocturnal in their habits, stand prolonged exposure to the sun very badly. The condition generally occurs in animals that are well fed but irregularly worked, and then suddenly called on to do a long march in the heat of the day, and in weakly animals when subjected to long exposure, or in those that are of a nervous or excitable temperament. The digestive system when out of order tends to increase the susceptibility.

Symptoms.—The symptoms usually come on towards the close of a trying hot march. There is evident distress and dullness ; the animal is fatigued, and slows down in his pace ; the breathing is hurried and the ears droop ; the trunk is lax and not swung about freely ; if these symptoms escape notice, the prostration increases until the animal more or less suddenly falls down in a faint. The temperature may be subnormal. These cases are met with most frequently when the atmosphere is moist, oppressive and still.

Treatment.—Immediately remove the load and gear. Dash cold water if possible from a height for some time over the head, neck, chest and along the spine ; if lying in the sun, run up a single or double tarpaulin as an awning to afford shade, but not so as to impede free circulation of air ; for the same reason, men should not be allowed to crowd around. Wash the face, head and trunk with cold water and sponge out the mouth and lips with weak vinegar and water or plain water. The head and face should be fanned if there is no breeze ; a weak solution of ammonia, if any be handy, poured on to a wet cloth, which may be thrown or placed on a bamboo near orifices of the trunk, may prove beneficial. In mild cases, after a little time the animal pulls round and will drink some water if presented ; when he gets up he should be kept in shade. A full dose of physic may be given with advantage. Clean fresh grass in moderation should be allowed ; it is better to reduce the

ration for some days. Whenever possible, arrangements should be made for the load and gear to be taken into camp. After a rest of from thirty-six to forty-eight hours, he may during the cool hours of the morning or late evening be quietly taken to camp. Great care, however, must be taken to avoid subjecting the elephant to exposure to sun for a considerable time afterwards.

Death may occur quite suddenly from failure of the action of the heart.

HEAT APOPLEXY OR HEAT-STROKE.

The symptoms are similar to those met with in heat exhaustion, but the animal may be somewhat excited; he staggers about, trembles all over, breathes very hurriedly and finally falls down in a more or less unconscious state. In some cases there may be symptoms of delirium ending in convulsions, great difficulty in breathing, coma and death. The temperature ranges high.

Causes.—Heat apoplexy may occur either while an elephant is idle, in the shade or at work. In many cases the animal if examined beforehand would probably have been found feverish and out of sorts; if worked in this condition, he shows weariness and fatigue, the temperature may rise to such an extent as to bring about a stroke.

Treatment: Preventive.—Do not permit elephants to be worked in the sun during the day in the hot weather, *i.e.*, between the hours of ten and half-past three. If work has to be performed during these hours, the head should be protected by a quilted cotton pad. Frequent rests are desirable and the animals permitted to take water in small quantities occasionally. It may even be advisable, on a long march, to halt the animals two or three times and relieve them of their loads, allowing a rest for three-quarters of an hour. Before being sent on the march or put to work, it is a good plan to have every animal carefully inspected; any showing symptoms of fatigue or ill health should on no account be sent out. On the march some person ought to be held responsible to look after the elephants while travelling; should any show signs of distress, evidenced by slowing down, staggering in their gait or trembling, they should be halted (in the shade if possible) without delay, the load and gear quickly removed and cold water dashed over the head and spine; even if relieved by these means, they should not be permitted to proceed on the journey till the evening or early next morning.

One attack predisposes the animal to another; therefore every care ought to be taken to avoid causes calculated to induce a recurrence.

Curative.—As in exhaustion, crushed ice if procurable should be applied to the head and spine; if not, continuous cold water applications. The state of the temperature of the body ought to be noted at intervals. The patient may recover, but restoration to health is very slow, and not infrequently paralysis in some form may develop. Tonics are useful during convalescence.

Death may result in a few hours from failure of the action of the heart, suffocation or from exhaustion following on the intense heat and consequent failure of the vital powers of the body.

LIGHTNING-STROKE.

On one or two occasions elephants have been struck by lightning and killed. The effects of lightning naturally vary with the intensity of the flash: strong shocks result in immediate death by paralysis of the nervous system, while weaker ones produce unconsciousness and temporary paralysis. In many cases large or small areas of skin are burned.

CHAPTER XIV.

DISEASES OF THE EYE.

THE EYE.

It is a matter of common remark amongst those who have much to do with elephants that a large percentage of them have blemished eyes. Major Hawkes notes, of a batch of 27 elephants examined, that one was totally blind, two nearly so, two blind in one eye, one had cataract in both eyes, and three had partial opacity of the cornea in both eyes. I think if we give the subject a little consideration the cause of this high percentage will be readily apparent.

The eye of the elephant is as delicate and sensitive as our own, and the preservation of sight is a blessing to the animal and an advantage to the owner ; yet mahouts are allowed (through ignorance of owners or those in charge) to inflict intense suffering on these creatures by blowing powdered glass, powders containing ingredients such as lunar caustic, blue-stone, camphor, etc., into their eyes to remove so-called films, or to treat the eyes with mixtures (applied unsparingly) containing other irritating ingredients in uncertain quantities, such as chillies, ginger, quicklime, preparations of mercury. When such delicate organs are subjected to treatment such as described, it is not surprising that we find so many elephants whose vision is permanently impaired or totally lost.

It should be made clear to elephant attendants that any treatment of the eyes carried out by them will result in their immediate dismissal. Captain Forsyth, a careful observer and sympathetic master, remarks : "The eyes of the elephant are extremely delicate and appear to possess in an unusual degree a sympathetic connection with the digestive organs. Nearly every indisposition of the animal is accompanied by a clouding or suffusion of the eyes. Few elephants that have been long caught, especially if in the hands of natives, have perfect eyes." Note the remark "especially if in the hands of natives." Mahouts are everlastingly tinkering with their elephants ; if not treating their eyes, they are treating them for some other supposed ailment. This amateur doctoring by them is a curse in elephant establishments. If more attention was given to seeing that these men take their animals to good grazing grounds,

that they give them their salt, flour or grain ration, that they are washed and groomed, and not tethered in the sun or overworked, the elephants would keep in better health.

In the human subject, the eyes are often affected in general bad health. In fact Nettleship remarks that "Ulcers of the cornea are so often a sign of bad health that we ought never to neglect such means as may be called for to improve the general condition."—"Diseases of the Eye," page 82.) There are many ailments also in which changes of the eye occur as part of a general disease. From what has been said it will be admitted that the treatment of eye diseases should not at any rate be entrusted to mahouts. What I particularly desire to impress on those who have charge of elephants is the importance of not leaving the treatment of the animals in the hands of the attendants. Remember that affections of the eye often depend on more than local causes; endeavour to ascertain them and if found to be not purely local attention must be paid not only to treating the eyes, but to the general state of the health. So important is this subject, that Macnamara, writing of ulceration of the cornea in the human subject, says: "In most cases, instances of ulceration (excepting traumatic cases, or those depending on conjunctivitis), the patient's general health will be found at fault; in no affection of the eye is it more necessary to attack the disease by improving the assimilative and nutritive functions of the body, and as a general rule a tonic and supporting plan of treatment is demanded. Iron and quinine, good food, cleanliness and fresh air are the fundamental requisites for the cure of almost all instances of ulceration of the cornea, whether they be of the sthenic or asthenic type. One frequently sees cases of ulceration of the cornea which resist all treatment, but which rapidly improve if the patient is sent to the sea-side, or, still better, for a voyage to sea."—"Diseases of the Eye," page 209.) I have quoted this at length, as it has such a practical bearing with regard to elephants, except perhaps the change to the sea-side, or a voyage; but a change to their jungles and a free life for a time will prove as beneficial to them as a change to the sea-side for a human being.

Certain precautions are necessary in the treatment of diseases of the eye. Nitrate of silver (lunar caustic) and sulphate of copper (blue-stone) should never be employed in the solid form, as irreparable damage may result from the application of such strong caustics. If it is desired to employ them, very weak solutions only should be used. Absolute cleanliness is imperative: attendants dressing eyes with filthy hands and with rags still more filthy should not be tolerated. For the purpose of wiping the eye, there is nothing

better than old soft linen, or lint, which should be cut into small pieces and used as required. After use, the soiled pieces should be buried or burned in order that flies should not rest on them and thus, if an affection be contagious, carry it to other animals. In fact it is a sound rule never to use pieces of lint, cloth or sponges a second time. Natives have no idea of the importance of cleanliness in these diseases, and will wipe the eyes with filthy rags, will even drop them on the ground, and use them immediately after.

Elephants are often unusually nervous when their eyes are sore. When it is desired to examine the eyes, the keeper should always be present, and the animal's attention diverted as much as possible by feeding him with some favourite food. The medicine must be made up and the mahout given careful instructions how to use it; a responsible person should be present to see the eye dressed.

Elephants with impaired vision or those whose sight is lost should be approached with great caution; they should be spoken to and given the *wind*, otherwise, if approached quietly and the wind be not in their favour, even a quiet creature might through sudden fear cause serious damage. It is almost useless for a stranger to try and dress an elephant's eyes; the keeper alone is generally the only person who can do this.

Elephants will not as a rule permit much handling of their eyes, as on the least interference they bring the nictitating membrane into play. The best thing is to get as good a view as possible without touching. When examining an eye the attention may be attracted by some one on the opposite side.

Considerable experience has proved that with patience and care excellent results can be obtained by judicious treatment.

During the hot season, if elephants are tethered in the glare of the sun, it is a good plan to cover the forehead and eyes with a cloth frequently wetted, or a shade.

OPHTHALMIA OR SORE-EYES.

Causes.—Undue exposure to the glare of the sun, irritation from cold winds, smoke, dust, grass seeds, etc., and injury from bites of insects, blows or abrasions, eating to excess the leaves and boughs of the peepul (*Ficus religiosa*, *nyaungbin*), contagion from another animal.

The condition may affect one or both eyes.

Symptoms.—When lids are separated, excessive redness, swollen eyelids, frequent blinking and a tendency to keep the eyes closed,

increased secretion (at first watery, later turbid), obvious pain and discomfort.

Treatment: Local.—Protect the animals as much as possible from strong light; put a shade on to exclude dust and flies; these can be made with a dark cloth, Chinese matting painted green, plantain leaves. I have never found an elephant object to such shades.

For the relief of pain hot fomentations frequently applied, to which may be added extract of belladonna 1 to $1\frac{1}{2}$ drachms to a pint of water (Formula 94), or the extract alone rubbed down in glycerine (Formula 95), may be smeared round the eye. As the discharges run over the cheek they may produce soreness, and to prevent this the parts below the eye should be smeared with sweet oil or vaseline.—(“Eye-washes,” Formulæ 89 to 93.)

General.—Consists of plenty of good food and tonics (Formulæ 39 to 46).

INFLAMMATION OF THE CORNEA.

The cornea is the transparent disc like a watch-glass in front of the eye, through which the colour of the eye and pupil can be seen. In health it is perfectly transparent and its surface smooth and glistening, so that it reflects objects like a mirror.

Causes.—A low state of health as in advanced debility, blows, injuries, or wounds of the cornea caused by the entrance of foreign bodies, or abrasions, such as might occur when moving through jungle.

Symptoms.—The same as in ophthalmia, with the addition of dimness, loss of polish and transparency; the cornea may appear like ground glass or be quite milky; this cloudiness is due to infiltration and exudation into the substance of the cornea and is not due to the growth of a film over it as is frequently supposed; hence the futility and cruelty of blowing in such materials as powdered glass, lunar caustic, etc., for its removal.

Treatment.—Same as in ophthalmia.

ULCERATION OF THE CORNEA.

Ulcers may occur in this structure as in other parts, and by a careful scrutiny will be recognised by the presence of a pit or lack of substance on the surface which may be pin point, but are usually larger; at the particular spot the reflection of objects is found to be

lost. Under proper treatment this should resolve and the cornea in course of time regain its original transparency but it often happens that a scar persists, shown by an opacity which may be permanent.

The symptoms leading to a suspicion of the presence of ulceration are similar to those manifested in ophthalmia and the treatment identical. When the ulcer has healed and an opacity is left, calomel on a camel's hair brush should be flicked into the eye once daily to hasten absorption (Formula 97) ; or a small portion (about size of a split pea or hemp seed) of yellow oxide of mercury ointment (Formula 96) inserted under the lid once daily may prove beneficial. Opacity of the cornea is sometimes seen in old age ; it is generally observed around the margin of the cornea, appearing as a faint milky ring.

Treatment.—Nil.

STAPHYLOMA, THE "MOTHEA BEENJ" OF NATIVES OF INDIA,

Is applied to a bulging resembling a small blister on the surface of the cornea.

Causes.—Ulceration. Occasionally an ulcer eats its way deeply into the substance of the cornea which may become so thinned that the pressure of fluid within the eye bulges the floor of the ulcer forwards.

Symptoms.—In addition to the bulging, which is a sequel to an ulcer, there is impaired vision ; owing to movements of the lids this blister may rupture and fluid from the eye escape, but this is nevertheless a remediable condition and the eye with proper care may regain its usual appearance and function.

Treatment.—As already laid down in ophthalmia. It is desirable whether pain be present or absent to smear extract of belladonna around the eye.

CATARACT.

This term is applied to an opacity of the lens (which is a transparent body situated behind the pupil) and not, as is often supposed, to opacity of the cornea, the condition last referred to.

Causes.—Blows on the eye and changes consequent upon old age.

Symptoms.—There is partial or complete blindness, attraction to which is drawn by peculiar behaviour of the animal. If the eye is carefully inspected in these cases, the only change likely to be seen

is an opalescence or haziness of the pupil replacing the jet black normal appearance. They generally develop slowly (months or even years) but when due to severe blows or injuries of the eye may appear in a few days. They tend to culminate in complete blindness. As a rule the cornea is quite clear, but should there be opacity, it is independent of the cataract.

Treatment.—Nil.

CHAPTER XV.

INTERNAL PARASITES :—SYMPTOMS OF THE PRESENCE OF PARASITES.

PARASITES IN THE ALIMENTARY CANAL.

This is a subject of the greatest importance, and is deserving of the careful and earnest attention of all those persons who may be placed in charge of these valuable animals. Though Gilchrist, in his work on elephants published in 1841, and others since then have mentioned the subject, we owe the greater part of the knowledge we now possess to the late Dr. Cobbold the eminent Helminthologist, and Colonel Hawkes late of the Commissariat Department. It may be accepted as a fact that elephants in Burma are much troubled with parasites. It is exceptional after death not to find them in the intestines, or livers of tame and even wild elephants. Elephants in India seem also to be much troubled with them. Forsyth writes: "Elephants are very liable to intestinal worms. They generally cure themselves when they get very troublesome by swallowing from 10 to 20 pounds of earth. They always select a red-coloured earth for the purpose. In about twelve hours purging commences and the worms come away."

Cobbold, writing on the important part played by internal parasites in the production of endemics and epizooty, remarks: "Depend upon it, many a death, hitherto reported as resulting from inflammation of the intestines, colic, splenic apoplexy, sunstroke, or to some other obscure cause, has been primarily due to entozoa, the presence of which may not even have been suspected during life." A parasite is a plant or animal which, living in or on another plant or animal, obtains its sustenance from its host to the detriment of the latter. In most of the larger mammals, however, there are generally to be found certain species of worms which, so far as is known, are not hurtful to their host. In the following lines an endeavour will be made to distinguish between those parasites harmful to the animal economy and those that are not.

The internal parasites most frequently met with in the elephant are :—

- | | |
|------------------|---------------------------|
| (1) Bots. | (3) Flukes. |
| (2) Round worms. | (4) Bladder worms (rare). |

(1) Bots (*Cobboldia elephantis*)—Are the larval forms of various "gad-flies" (Family *Æstridæ*). The most common gad-fly of the elephant is about the size of an ordinary bee, of a dark greyish colour, is very soft and easily killed. They are abundant during the early rains and grassy places swarm with them. They are a veritable pest, hence at these times elephants, bison, sambur, etc., keep as much as possible to heavy cover. In the hills during continued wet weather these flies are also very troublesome. Gad-flies attach their eggs to hairs in various parts of the body: in elephants usually the hairs about the mouth, or to the tusk by the gums, etc. These are swallowed and the eggs hatch out in the stomach, pharynx, etc. Bots adhere by means of cephalic or head hooks which they insert into the mucous membrane. After arriving at a certain period in their growth they voluntarily release their hold and are usually carried down the intestinal canal until they eventually escape with the dung. In appearance they resemble whitish red grubs, about $\frac{3}{4}$ to an inch in length; the body is divided into segments and the hooks by which they adhere are visible without the aid of a lens. During the passage down the intestinal canal they may re-attach themselves.

It is by no means uncommon to find *post-mortem* a patch of bots often up to one hundred in number in the gut. On escaping from the bowels they bury themselves in the ground, where their skin shrinks and hardens into a case within which the pupal stage is assumed. In the course of a fortnight or six weeks they emerge as full-blown gad-flies.

Bots may also be found in situations other than the stomach and intestines, *e.g.*, in the gullet, occasionally in quite large numbers, also in the pharynx, frontal cavities, etc.

Steel records that a bot (*Pharyngobolus Africanus*) has been found in the pharynx of the African species. That bots find lodgment in the pharynx of the elephant in Burma is certain. It is not a rare occurrence for an elephant to suddenly commence a sort of coughing or sneezing and blow bots out of the trunk.

Symptoms.—Usually none, but there is little doubt that when present in large numbers they cause some mechanical irritation. It is however impossible to diagnose the condition unless bots are found in the excreta. If treatment is considered desirable a dose of physic and a liberal allowance of salt may prove of some service.

(2) *Round worms*.—As far as is known the round worms are all small, whitish or yellowish in colour, about the thickness of ordinary twine. Some kinds may be found in immense numbers in the bowels and often in the dung. All round worms are known to Indian mahouts as "soorti" or "chotee."

(a) *Ascaris lonchoptera* may be met with in common with other round worms, they are from $1\frac{1}{2}$ to $2\frac{1}{2}$ inches in length.

Symptoms.—Generally absent; presence known by observing them in the dung.

(b) Two species of *Uncinaria* (*Anchylostomes* or *Dochmius*) have been described:—

- (i) *Dochmius Sangari* (Cobbold), so called after Sangar of Circus fame, who lost all his performing herd of elephants through this worm. The male measures $\frac{3}{8}$ inch and the female $\frac{3}{4}$ inch.

Symptoms.—Severe diarrhœa which resisted all treatment.

- (ii) *Uncinaria os papiliatum* (Ostertag), which is stated to occur only in Indian elephants.

In the Report of the Imperial Bacteriologist for 1902-03, paragraph 69, Dr. Lingard mentions having examined specimens of elephants' blood which indicated death from *Uncinaria os papiliatum*, lately described by Professor Ostertag as occurring solely in Indian elephants.

The following is a translation from the "Berliner Tierärztliche Wochenschrift," which appeared in the "Veterinary Record," dated 18th April 1903:—

"WORMS IN ELEPHANTS—BY PROFESSOR SCHMALTZ.

"Busch's Circus in Berlin had at the pantomime a herd of elephants freshly imported from India by Hagenbeck, of Hamburg. Two of these elephants died a short time after each other, and through the kind offices of Veterinary Surgeon Klingner, who holds the position of Veterinary Surgeon to the Circus, they were presented to the Anatomical Institute of the Veterinary University to be placed in the museum. Naturally the cause of death was examined.

"*Post-mortem* gave an interesting and similar state of things in each subject in many points. Both carcasses were blood warm and hydræmic. The subcutaneous tissue was so soaked and saturated that on cutting through it yellow watery fluid collected.

"In some cases under the skin were flabby swellings. The whole of the muscular tissue was extremely pallid, and its colour a clear brick red. In the abdominal cavity large quantities of clear fluid.

"The internal organs up to the small intestine were generally healthy. This was reddened externally; its contents were tinged

with blood. With the exception of from 1 to 2 mm. in length at the beginning and end, the mucous membrane of the small intestine was very much swollen and covered with a greasy layer. It was studded with punctiform hæmorrhages and large petechiæ, and contained many flat depressions with reddened bases. In these depressions and along the whole mucous membrane, forming thick convolutions, numerous small round worms clung. These parasites were undoubtedly the cause of death. By their presence they had occasioned severe changes in the intestinal mucous membrane, and established the state known as worm cachexia. It was also evident from the state of the body that they had occasioned considerable and continued loss of blood.

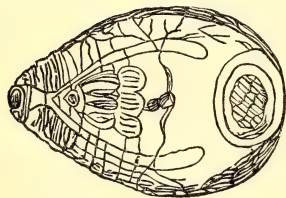
"The worm was examined by Professor Dr. Ostertag, who pronounced it to be *Uncinaria os papiliatum*, a worm which only occurs in Indian elephants.

"The remaining elephants were treated with santonin, which effected the removal of a great quantity of the worms. The state of health of the survivors has since been satisfactory. A prophylactic taenicide in freshly imported young elephants has not hitherto been noted."

Uncinaria are found in elephants in Burma. A parasite which appears to belong to this species is not infrequently found in the ducts of the liver where it sets up much irritation. On several occasions *post-mortem* examination has demonstrated some of the ducts to be choked with these parasites and local changes to have occurred in the organ to such an extent as to warrant even death being attributable to their presence. Observation, however, on the effects of extensive infestation by round worms in elephants is very desirable. *Uncinaria*, though insignificant in size, are often by their numbers and blood-sucking propensities the cause of debility, diarrhœa and loss of life. In making *post-mortem* examinations therefore trouble should be taken to examine the mucous membrane of the small intestines thoroughly for small hæmorrhages and to see if there are any small parasites adhering thereto.

(c) Cobbold mentions that certain round worms are found in small tumours in the coats of the stomach. If such tumours are met with they should be incised, and if parasites are present they should be carefully preserved and labelled.

Treatment for round worms.—A course of treatment of such drugs as sulphate of iron, arsenic, santonin, and thymol in doses of $\frac{1}{2}$ to 2 drachms (*see* also Formulæ 47—53 and 39—46) is to be recommended. At intervals during this treatment the bowel should be opened by a mild purgative, and enemas (*see* Formulæ 85 and 86) should also be at times administered.

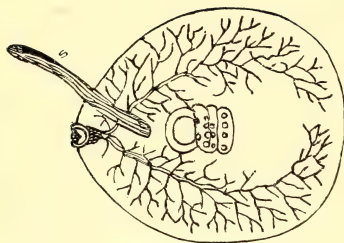


About natural size.

Amphistoma Hawkesii (after Cobbold).



Bots about natural size.



Jackson liver fluke (after Cobbold).



Ascaris lonchoptera, about natural size.

(3) *Flukes*—(a) *Amphistomes*.—These are frequently found in numbers in elephants, the better known variety being the *Amphistoma Hawkesii*. These parasites are well known to mahouts. Colonel Hawkes in May 1875 sent some specimens to Dr. Cobbold, who, finding them new to science, named them after the donor. They are common, and are termed *masuri* or *mussodee* by the attendants. Owing to the large quantity of fæces passed at a time by elephants, and the small size of the parasites, attention is not attracted to them. Their abode is the large intestine, to the membrane of which they adhere by means of their suckers. They are of a delicate flesh pink colour. Steel gives their size as $\frac{3}{8}$ — $\frac{1}{4}$ inch. Sometimes however we find specimens measuring $\frac{5}{16}$ — $\frac{7}{16}$ inch. They are not unlike barley-corns in appearance.

They may on examination be readily recognized under a lens by the presence of a circular sucker placed at each extremity of their bodies.

It is only when they are present in very large numbers that they set up much irritation of the bowel, causing severe and frequently most persistent diarrhœa, during which a truly marvellous number of the parasites may be expelled. It is a matter of common remark amongst mahouts that, when elephants are troubled with parasites, they resort to eating earth for the purpose of inducing purgation, in order to rid themselves of these unwelcome guests. The eating of earth may go on for a couple of days, the amount eaten being from 2 to 4 pounds at a time, until free purgation is produced, after which no more earth is eaten. Steel, however, proved that this eating of earth is not the whole and sole cause of purgation. In the case of the elephants owned by Sangar they were not supplied with earth, though they searched for it with their trunks yet they succumbed to diarrhœa. This habit of eating earth does not always denote the presence of parasites. It frequently points to the fact that an animal is not receiving salt, or if a ration of salt is allowed that it is insufficient. Wild animals such as deer, bison, sine and elephants make frequent and regular visits to "licks" and eat quantities of earth, and though in the jungles one frequently sees the droppings of wild animals, it is not often that one finds parasites. This parasitical diarrhœa often proves fatal, especially in young animals and in adults when in a low state of health.

(b) *Liver Fluke* (*Fasciola Jacksonii*).—The term "flake" has been applied owing to its flatness, being likened to the fish known as the fluke or flounder. It has a somewhat rounded outline and, when examined under a glass, it will be seen that the body is covered with minute spines. By a peculiar arrangement in the structure of the sucker, these creatures are enabled to adhere to the

mucous membrane of the bile ducts with such tenacity as to resist the contraction of the bile ducts to expel them with the bile into the intestinal canal. The colour varies a great deal, depending to a great extent on the amount of bile they contain; if their digestive system be full of bile, the colour is a dark brown or greenish black; if empty, a dark yellowish brown.

Cobbold gives the length, when unrolled, from $\frac{1}{2}$ to $\frac{5}{8}$ inch and the breadth from $\frac{1}{3}$ to $\frac{1}{2}$ inch. The habitat of flukes is in the bile ducts of the liver, which they invade from the opening through which the bile flows into the gut, situated a short way from the stomach, and it is to their presence that the disease known as *rot* owes its existence. In Burma flukes may occasionally be met with in mules and ponies, but more frequently in oxen, buffaloes and elephants. Hawkes, a careful observer, who knew much about the diseases of elephants, constantly found after death these parasites in the bile ducts. This has frequently been my experience. While he was stationed at Secunderabad a high mortality occurred amongst the elephants under his charge. He attended the *post-mortem* examinations, and flukes were found in greater or less numbers in every case; he also observed that other parasites were met with. A long account of an outbreak of *rot* which occurred in 1867 amongst the Commissariat elephants stationed at Rangoon is given in a letter to the "Rangoon Times," dated the 16th July 1867, and signed "R. B." It appears that in the short space of fifteen days seven elephants died, and it was noticed that the mortality commenced as the severity of the south-west monsoon increased. The outbreak was such a remarkable one that I give some extracts from the letter:—

"* * * The first sign I noticed of the disease was the number of elephants which resorted to eating mud, the natural remedy provided by the animal's own instinct for the expulsion of intestinal worms. Perhaps the animal resorts to mud not only as a remedy for worms, but also when any excess of irritation in the bowels or stomach is felt; however, be that as it may, in all the cases which came under my notice, I am confident the cause of death was from the presence of cystic and larval forms of the entozoa, which were found in abundance in the liver, lungs, and intestines of the animal.

"In the lower bowels or alimentary canal the common worms were found in great numbers, termed "chotee" or "mussodee" in Dr. Gilchrist's Treatise (a species of *ascarides*?), and it was not until the liver and lungs had incisions made in them that the other kind was discovered.

"The inside of the liver and cavities of the lungs were, I may say without exaggeration, positively alive with this species of

distoma, for I believe it to be such, at least as far as I am able to judge in comparing its diagnosis with those mentioned in Davaine, "Traité des entozoaires," of which at pages 49 and 322 a very accurate description is given, with the exception of some slight variations, which only determine this to be a different species.

"The form of the one (a specimen is herewith sent) now spoken of is somewhat more round, which I think may be likened in shape to the old-fashioned lady's reticule, and of about the size of the nail of the forefinger. The body is compressed, soft, with two distinct orifices—one marginal, forming as it were a small pointed distension on its margin, the other between the middle and anterior sixth of the body. Just above the ventral orifice there is a kind of elongated appendage or sucker, in length about the same as the body, but when pulled out by the forceps extends beyond the margin; it appears slightly elastic with the end distended. Under the microscope the external covering or epidermis appears pitted and, when subjected to the action of dilute nitric acid and mounted on a slide in Canada balsam, the intestinal ducts are plainly visible containing dark-coloured granules, being free near the orifices, but thickly reticulated towards the margins with clavate terminations. There are, as far as I could discover, no hooklets in mouths, as stated to be in *echinococcus* or *larvæ* of *tæniæ*. From the absence of these characteristics, I have been led to conclude it to be a species of *distoma*.

"* * * Davaine mentions that animals such as the ox and horse frequenting marshy, swampy places are subject to the *distoma*. It is most probably the truth, but I think during very prolonged hot weather, when the water is reduced to its lowest stagnant state and mixed with the lower organisms of animal life, the elephant then imbibes them with the water in their embryonic form. In this opinion, I believe, I am in a great sense supported, for from inquiry I find the virulent diseases which have attacked cattle in Burma have been during a heavy monsoon, after a continued hot season.

"* * * The disease is not one which develops its symptoms by different stages, but carries the elephant off in a few hours and might, I am sure, be taken for apoplexy, or inflammation of lungs, for the symptoms correspond in character with those described by Dr. Gilchrist. The elephant exhibits difficulty in breathing; it keeps its mouth open, is restless in most cases, and refuses food; there is a puffiness about the head and shoulders.

"Besides the Commissariat Department, others have suffered in the loss of elephants. The Forest Department lost their elephants, and reports have reached me that wild elephants have died. This may be, for the wild elephants in a droughty season are

necessarily subject to the same influences as the trained ones. I would particularly mention that those elephants of this department which were during the hot weather kept in the cattle lines, partially in sheds and well cared for, have up to this time escaped.

"The sufferers have been those sent from the scarcity of forage to the jungles to graze. * * * *"

With reference to this outbreak the symptoms appear to have developed suddenly, and the disease to have run a very rapid course. It is possible that the deaths were really due to some specific disease. It will be observed that the elephants that were kept in the lines escaped, while those only that were sent out to graze contracted the malady. There is no doubt that flukes and amphistomes were present in these cases.

The natural history of the *Fasciola* or *Distoma hepaticum* of the sheep has been carefully worked out, and to those interested in the life history of this parasite I would recommend a small book by J. B. Simonds on "The Rot in Sheep." It will be sufficient to state here that the progressive changes and transformation through which this parasite passes from the egg to the mature fluke take place outside the body of the creature they ultimately inhabit. They enter the body in their penultimate form and are parasitic only in their mature state. They do not multiply in the body. It is a well established fact that the *fluke* disease or *rot* is essentially a disease of low-lying, inundated tracts, and wet seasons. There is little doubt that some of the cases called *thut* by the Burmans and *zahirbad* by the Indians are true *rot*.

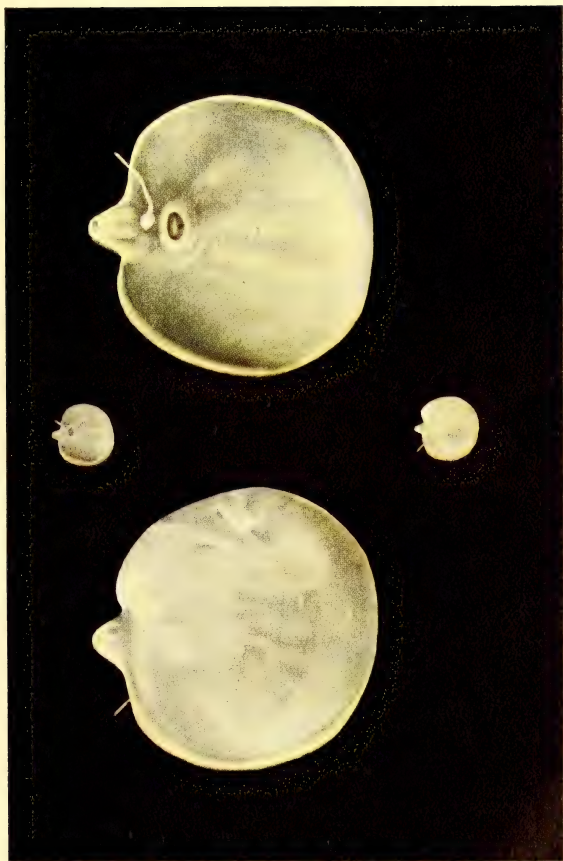
As is the case in most ailments due to parasites, the early symptoms of *rot* are ill-defined, and may not even lead to a suspicion of the cause.

In these diseases the symptoms depend on the number of parasites and inconvenience caused by their presence, and also to the importance in the animal economy of the particular organ invaded.

A few flukes in the bile ducts may give rise to but slight irritation and impairment of function; whereas, when they invade the ducts in large numbers, the pressure and persistent irritation caused may lead to such rapid and extensive structural alterations as to speedily cause death. Under certain conditions the progress of *rot* may be very rapid, such as in animals that are hard-worked, ill-fed and exposed to all weathers; also in cases where animals already in a debilitated state are attacked. Young animals are sometimes invaded by such large numbers of flukes that they impair the function of the liver to such an extent as to rapidly destroy life.

As a general rule the progress of *rot* is slow; one constant symptom is progressive wasting away, due to anæmia. This is not

PLATE XII.



FASCIOLA JACKSONI.

Enlarged and natural size. Natural Colours.

surprising when we know that an organ of such importance as the liver is the seat of disease. The secretion of the liver, namely the bile, has a most important office to perform. When the ducts are crowded by these creatures, the pressure, irritation, etc., must lead to impaired secretion and consequent alteration in the quality and quantity of the bile. The gland gradually ceases to perform its office in an efficient manner, thus the blood becomes affected and impure in quality. The flukes as they become mature travel up from the main channel into its numerous ramifications in the liver, for the purpose of depositing their eggs. The result of this persistent irritation is increased vascular action, which leads to the coats of the ducts being considerably thickened and their calibre decreased.

Symptoms.—Dulness, lassitude, frequent yawning, general unthriftiness shown by a dry scurfy skin; the appetite fastidious, one day the patient eats well and on the following day is “off feed,” possibly only eating earth; thirst is frequent, the membranes are pale or yellowish in colour, the mouth clammy; there may be puffiness about the head and shoulders; frequent attacks of severe and often persistent foetid and dark-coloured diarrhœa, which usually contains specimens of the offending parasite; this symptom is particularly pronounced in the case of *amphistomes*; there is gradually or rapidly progressing debility and loss of flesh; later on dropsical swellings, finally extreme exhaustion ending in death.

Treatment : Preventive.—Consists in following out what has already been laid down with regard to the management of the elephant in health with especial reference to food, which should not be procured from wet or marshy tracts (wet being essential to the development of these parasites), good water, and *an ample allowance of salt*. When flukes are discovered, the animals *must be removed to high ground*.

If mahouts carefully inspect the dung daily as they should do, parasites would often be discovered at an early stage before the elephant becomes debilitated, and successful treatment and early restoration to health would probably ensue. Inspection must be close and careful, for these dangerous parasites are very small and their presence very easily overlooked.

The dung of any animals found suffering from worms should be collected and mixed with carbolic powder or chloride of lime or destroyed by fire.

Diarrhœa need not be checked unless very severe or the animal very weak. Stimulants, such as brandy, rum, etc., are at such a time of service.

Curative.—See Vermifuges, Formulæ 47 to 53, Tonics—39 to 46, also 85 and 86.

Tonics, especially arsenic, sulphate of iron, copper and nuxvomica, most useful during convalescence.

(4) *Bladder worms (Hydatids).*—This is a cystic or bladder-like condition met with in various organs and tissues, but more usually in the liver, and represents the immature stage of a tape-worm, which in its mature condition inhabits the bowels of dogs, wolves and jackals. Its cycle of existence is as follows.

To begin with the egg. This is passed in the fæces of one of the above animals and may gain entrance to the alimentary canal of an elephant by its feeding on pasturage, etc., contaminated by their droppings. The egg having once gained entrance to the stomach of the elephant, hatches and liberates an embryo, which displays a desire to migrate, passing through the walls of the stomach, by the aid of six hooklets with which it is provided, to some suitable spot, most frequently the liver. Having found a suitable resting place it casts these hooklets and becomes invested with a fibrous capsule or wall. At this stage it is known as a hydatid cyst.

The hydatid cyst when fully developed consists of a wall with fluid contents, and within it other smaller cysts or bladders are developed, and within these again others may form to a third and fourth generation. These so-called daughter and grand-daughter cysts contain fluid and embryo tape-worms, which are called at this stage "scolices." The scolices consist of a head identical with the adult tape-worm, a constriction separating it from the body, and a pedicle or foot which is attached at some stage to the wall of the cyst, but which frequently gives way setting the "scolex" free.

The scolex cannot develop further in the elephant. The hydatid cyst thus affords a haven for the propagation of the species which can only develop to the stage of "scolices." In doing this it increases in size, often to an enormous degree. In order to complete the cycle of the creature's existence the "scolices" must find their way into the stomach of a dog or kindred animal, which they usually do by this animal eating the organs or flesh of an animal infested with hydatids, the sheep perhaps being the most frequent source.

The scolex having reached the canine stomach becomes endowed with renewed vitality and develops into a mature tape-worm.

The mature worm consists of a head furnished with four suckers, two rows of hooklets and three body segments, the last of which is provided with reproductory organs.

This worm is commonly seen voided with the excreta of dogs and measures about $\frac{3}{4}$ inch in length. The adult worm produces numerous eggs, which are also voided with the dog's excreta.

It will be seen from the above that, if the ova of the tape-worm gain access to the canine stomach, no tape-worm can result, since it must of a necessity pass through the system of a sheep or kindred animal and pass through the stage of hydatid cyst.

In the same way, should a scolex find its way into the stomach of an elephant no hydatid cyst will result, since the scolex must of necessity pass through the system of a canine animal before again arriving at this stage.

Elephants therefore cannot directly communicate the parasite to one another but only indirectly through the media of dogs, wolves, and jackals.

The dangers of hydatid cyst are—

(a) It may increase and rupture.

(b) It may suppurate and become an abscess.

On the other hand it may rarely be absorbed and disappear.

Treatment : Preventive.—It follows from the above that mahouts should not be allowed to keep dogs about elephant standings and, should dogs' droppings about the standings be discovered, they should be collected and burned.

When diseased liver and lungs are discovered after death they should be treated likewise.

TYMPANITES.

Definition.—The formation and accumulation of an abnormal amount of gas in the stomach or bowels.

Causes.—It may simply be due to the fermentation of food as in cases of simple indigestion. Occasional attacks may be met with in animals whose digestion is much impaired and it occurs in flatulent colic. It however is met with as a symptom in very grave conditions, such as impaction, inflammation or twist of the bowels, peritonitis, etc., and in such cases it is usually regarded as a very unfavourable sign. Simple tympanites may be distinguished from the graver diseases in which it may occur by the state of the pulse, temperature, and injection of the membranes, also the fact that it usually is seen later on in the course of these diseases.

Symptoms.—Evidence of pain, which may be intermittent or continuous and sometimes violent. Considerable distension of the abdominal cavity causing a tense drum-like condition of its walls, most noticeable in the flanks, often great distress in breathing. The animal may stand very quiet, but in some cases may be semi-delirious. Pain on pressure of the abdomen. Sometimes there is passage of wind.

Treatment.—In cases where the temperature and pulse are more or less normal and the mucous membranes not injected, enemas should be frequently administered and a dose of medicine given to evacuate the bowels. Any of the following may also afford relief :—

No. 1.

Aniseed	...	...	...	1 oz.
Ginger	...	...	...	1 oz.
Rock salt	...	...	...	2 ozs.

To be repeated if necessary.

No. 2.

Opium	...	...	...	1 oz.
Ginger	...	...	...	1 oz.
Assafœtida	...	...	...	$\frac{1}{2}$ oz.
Whisky or other stimulant	...	...	...	8 ozs.

To be repeated if necessary.

No. 3.

Powdered green ginger	...	...	...	2 ozs.
Black pepper	...	...	...	$\frac{1}{2}$ oz.
Aniseed	...	...	...	1 oz.
• Whisky or brandy	...	...	...	8 ozs.

To be repeated in two hours if necessary.

If it can be given, four ounces of turpentine beaten up with eggs, milk, a little bicarbonate of soda added and mixed with a pint of castor or raw linseed oil may be of service.

In cases where fever is present no purgatives should be used, enemas of hot or cold water only being administered.

TYMPANITES AND CHRONIC LYMPHATIC LEUKÆMIA.

The following is an extract from an article by Von Dr. H. Jacob-München which appeared in the "Berliner Tierärztliche Wochenschrift," No. 43, dated the 22nd October 1908 :—

"An elephant, one year old, after breaking loose, gorged himself with hay, yellow carrots and freshly-baked black bread, was taken ill.

"*Symptoms.*—The trunk, the most moveable organ of an elephant, hung motionless. On touching it there was an absence of sensation. The mucous membranes of eyes, mouth, openings of trunk appeared anæmic. In consequence of the rectum being protruded the temperature registered was 35·5° C. (95·9° F.). The beats of the

heart could not be counted owing to the muscular spasms. Respirations 36, laboured, the muscles of the chest being mainly employed in the act. At times the animal groaned as if in pain. The abdomen was immensely distended and any pressure in that region caused the animal to groan. The usual rumbling peristaltic motion of the bowels was not heard. Examination per rectum showed that it contained yellowish brown liquid fæces. Higher up the hand encountered firm masses which appeared to be impacted.

"*Treatment.*—Enemas, massage of abdominal wall. One litre of Camomile tea, well sugared, and half a litre of brandy was administered. This soon produced a beneficial effect. Convalescence was protracted. Three weeks after first attack, he had a bad relapse. The animal could not rise, his breathing was difficult (stertorous) and the heart action weak. Jacob injected 30 c.c.m. (about 8 drachms) of spirits of camphor into the cardiac region of the moribund animal and examined, under the microscope, blood taken from the ear. He found a very large increase in the leucocytes (white blood cells), 1 to 67 red corpuscles.

"The animal died the same day of dyspnœa (suffocation).

"*Post-mortem examination.*—Chronic lymphatic leukæmia, œdema of the lungs and degeneration of the heart muscle. In the stomach were several *Gastrophilus Bots*, and in the intestines a very large number of *amphistomes* and *nematodes*. The animal was also suffering from *Distomatosis* (flukes). The illness of the animal is interesting in that the owner of the elephant sold the animal as sound shortly before the illness and was sued. Dr. Jacob as a result of his examination gave it as his opinion that the elephant had been suffering from lymphatic leukæmia which is sure to end fatally. That the parasitic invasion (*Gastrophilus* and *Distomatosis*) had taken place before the purchase of the animal and that his capability to undergo training was thus undermined.

"After the law case had run on for three years they called in the Court of First Instance and the seller's claim was dismissed with costs."

PART V.

Infective Diseases.

CHAPTER I.

GENERAL REMARKS.

CONTAGIOUS DISEASES are not only communicable directly from one animal to another, but may be indirectly so by the poison (virus) being carried by attendants or their clothes, contaminated fodder, or in water presented in utensils to which sick animals have had access. Dogs, etc., should not be kept in elephant camps. It is as well to remember these points.

2. It should be a rule to treat all newly purchased animals as having been exposed to contagion. They with their attendants should be kept quite separate for at least a fortnight. The animals should be inspected certainly once, if not twice a day. Any case of sickness should be forthwith isolated, the healthy animals divided into small groups and kept well apart. A strict watch should be kept.

3. At all times it is advisable to segregate any case of fever and keep it so until proof is afforded that the disease is non-infective.

4. In case of a disease being contagious the most important step is without delay to separate the sick with their attendants, gear, utensils, etc., from the healthy. Divide the healthy into small batches, picket them well apart and to windward of the sick camp. Take the temperature of the healthy animals twice a day, by this means any fresh cases will be detected in the earliest stage of disease and they can be removed to the sick camp at once, thus to a great extent arresting the further spread of disease. If this very necessary aid to detecting cases early be adopted, it will as a rule be found that the disease is confined to one or two groups and can be effectively dealt with.

5. With regard to the isolated area set apart for the sick camp this should, when possible, be near a stream and situated well below all other camps. The attendants and their sick animals should not be permitted to leave it. Forage, if it has to be brought, should be carried to the edge of the sick camp and then removed by attendants in the isolated area. One of the first duties should be to

have a number of pits dug for the reception of rejected fodder, moist dung and discharges, which should not under any pretext be allowed to lie about or be pushed a few yards away from the standings. Apart from the unpleasantness of such insanitary conditions filth tends to collect flies, and they not only irritate and worry sick animals but can and do carry infection in certain diseases. The pits should be covered in with two feet of earth. During the dry season there is no reason, apart from laziness, why all such material should not be destroyed by fire. The constant burning of such material on the windward side generally suffices to keep away the various kinds of insect torments frequenting elephant camps. When camps are within easy reach of railways or steamers a plentiful supply of cheap disinfectants should be obtained, perhaps the easiest carried is powder, such as McDougal's, Sanitas, etc., which should be freely used. Quicklime is very useful to throw over the refuse before filling in the pits. Standings should be changed frequently if only to a distance of 20 or 30 yards. When an animal is removed the ground should be covered with straw, grass or leaves, etc., and fired. Before moving from a camp care should be taken to see that it is left thoroughly clean, not only on account of the possibility of having to use it again, but to safeguard the animals of other owners who may perchance camp there.

6. As to diet of sick animals, plenty of good, freshly-made gruel should be allowed and freshly-cut green fodder offered. The healthy animals should be kept on green fodder; coarse, dry, indigestible food is objectionable at any time, but especially so during outbreaks of disease.

7. Ropes and other gear easily replaced that have been used or in contact with sick animals should be burned. All iron work, *i.e.*, chains, etc., should be run through a fire. Should a case of any dangerous infectious malady occur in a shed, if inexpensive, it should be burned. If costly, the walls must be thoroughly washed with boiling water mixed with very strong carbolic acid or phenyle. As the floor becomes soiled with the discharges, it is necessary to remove the earth to the extent of two feet at least, throw in new earth and disinfect the whole standing. The shed should not be occupied for some little time. All posts and other wood should be washed with strong carbolic and, later on, dressed with tar.

8. The carcasses of animals that die should be buried as near to the place of death as possible. If they have to be dragged to any distance the natural orifices should be plugged with tow or cloths wrung out of some disinfecting fluid to prevent, as far as is possible, soiling the ground. The grave, whenever possible, should be dug alongside the carcase. Where cremation is possible it should be

carried out though it takes time and is usually an expensive process. Anthrax carcasses should not be opened. Anthrax graves should be marked in some way, such as by fencing with rough logs, to prevent animals grazing over them or grass-cutters cutting grass over them.

9. A guard should be placed over a grave for 24 hours to prevent Burmans who are, as is well known, particularly partial to elephant's flesh from removing the earth and taking any flesh.

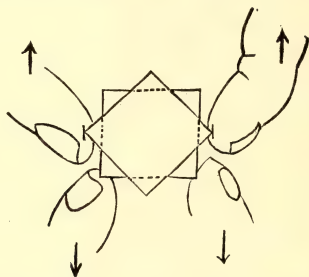
10. As later on it will be observed that certain diseases are common to other animals, it would be as well, before selecting camps near villages or grazing grounds, to ascertain from the villagers or herdsmen if such diseases as anthrax, hæmorrhagic septicæmia or foot-and-mouth disease are or have been lately prevalent amongst the cattle, etc., and if so such localities should be avoided. If this is not feasible the animals should be tethered on the highest ground available and no strange animals allowed near the camp. Animals should not be allowed to graze in the locality. Fodder and water should be brought to them; the former, if grass is given, should be cut well above the ground and rushes, reeds and swamp grasses on no account used. It is even better to restrict the fodder to boughs of trees, bamboos, etc. On the march, caravan and other tracks used by cattle-drivers and their camps should be avoided.

11. In such cases, where it is deemed advisable to help to a correct diagnosis of disease, blood smears should be taken and it is well to be acquainted with the method.

× *Method of making a blood smear.*—Blood smears are made either on little slips of glass called slides, or on squares or circles of very thin glass called cover-slips; these can be obtained from any chemist and all Europeans in charge of elephants should be supplied with them. Before making a smear one should see that the slips or slides, whichever are used, are clean and free from grease. To free a slide from grease it is only necessary to dip it in spirit and burn the spirit off. Before puncturing the skin wash it with some spirit, then pass the needle or point of lancet to be used through a flame and puncture. If blood is to be taken from more than one animal the lancet or needle should be cleansed by passing it through a flame before each operation. Wipe off the first drop or two of blood and then take up on the slide a minute quantity of blood; next apply the edge of another slide to the edge of the drop, wait till the blood runs along the edge, then gently pull the wet edge of the slide along the surface of the first slide, leaving a thin film of blood on it. It must be borne in mind that a *thin* film is what is required, and to make this very little blood is necessary. When the blood is *thoroughly dry* on the slides each slide should be wrapped *separately* in tissue or other soft paper and then packed in

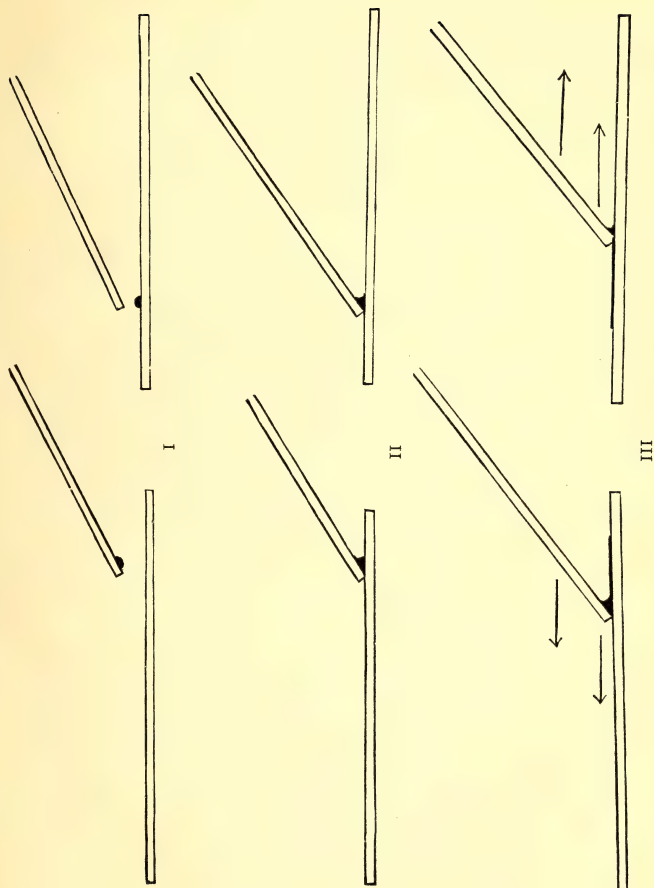
cotton wool. Thick slides and those that are packed film to film are no use for blood examination (*see* Diagram).

To prepare cover-glass specimens, a minute quantity of blood, or pulp from the spleen or other organs, or jelly-like diseased material is taken on the point of a needle which has just previously been heated in a flame. The material is placed between two cover-glasses, which are to be pressed gently together in order to expel any excess of material, and to leave a very thin layer between them; they are then to be separated by sliding them gently *one* over the other and allowed to dry under a watch or wine-glass to exclude dust, or the layer may be fixed by taking the cover-glass, coated surface uppermost, between the finger and thumb (*see* Diagram),



and passing it rapidly two or three times over the flame of a spirit lamp. When dry, they should be carefully packed separately in cotton wool with slips of paper intervening and placed in a small wooden box, and for extra protection this box should be again packed inside a tin one. About half a dozen specimens should be sent. All cover-slips, also slides, should be boiled and cleaned and kept in spirit.

DIAGRAM SHOWING METHOD OF MAKING BLOOD SMEARS.



The drop may either be taken up on the end edge or the middle, towards one end of one slide as in I. Another slide should be approached so as to contain the drop in the angle between the two slides, II. The drop will spread itself out along the line where the two slides meet. The drop should then be spread evenly over the bottom slide, by gently either pushing or pulling the end of the upper slide along its surface, III. Only a very small drop should be taken.

CHAPTER II.

GENERAL SEPTIC INFECTION AND INTOXICATION.

BLOOD POISONING.

1. Septicæmia is met with in two forms :—

(a) Septic poisoning.

(b) Septic infection.

(a) *Septic poisoning*.—The effects produced by the absorption of a poisonous dose of the chemical products of germs without the germs being alive that elaborate these poisons. In this the symptoms must be directly in proportion to the dose absorbed, which dose cannot increase in the body.

(b) *Septic infection*.—The effects produced by the absorption of poisons of living infective germs. The symptoms here are not proportionate to the initial dose which may be infinitesimal and not lethal, but which, owing to multiplication of the germs in the blood and a corresponding increase of poison elaborated by their vital processes, leads to death sooner or later.

This naturally is of a graver character than the preceding.

2. *Pyæmia*.—Occurs in the same way as septic infection, but differs in its symptoms.

Prognosis.—In septic poisoning, if the dose is small, recovery is probable. In septic infection and pyæmia recovery is rare.

Causes.—Always due to absorption through some abraded surface, *i.e.*, sores, scratches, heel cracks, abscesses. The poison may have been introduced by the weapon causing the injury or may have been absorbed subsequently from neglecting the wounds (a frequent cause).

Symptoms.—In all forms the following are the most frequent : repeated shivering often unnoticed, and sudden accessions of high fever, often followed by a fall of temperature sometimes to normal before the next rise, grave prostration and muscular tremors being marked symptoms, and towards the end foetid diarrhœa, occasionally there may be paralysis of the hind-quarters. The disease takes a rapid course, ending usually in death after a short period.

In septic poisoning no further symptoms are observed, but in septic infection there may be swelling of joints and collections of fluid in the body cavities (chest, belly), and in pyæmia abscesses

scattered over the body and in the organs. The cause of the formation of these abscesses is as follows. In the case of many wounds veins are injured and this leads to the formation of blood clots blocking the lumen of the injured vessels. The clot may extend until it reaches a considerable collateral branch. The clot is adherent to the wall of the vessel except at its free end which protrudes into the blood current. Clots may soften and break down. Small portions are thus detached and carried by the circulation to distant parts. As a rule they are arrested at the bifurcation of vessels. At such points infective centres or foci for suppuration are formed. Thus, according to the seat of injury different organs—the lungs, liver, kidneys, spleen—may become the seat of numerous abscesses, which are usually small and wedge-shaped. Unlike septicæmia, pyæmia does not supervene till some days after the receipt of injury. In septic infection death occurs more rapidly than in the other two forms.

Treatment: Preventive.—Is the most important and consists in strict attention to all kinds of wounds, however trivial, which if properly treated to a great extent precludes chances of infection.

Curative.—First thing necessary is local treatment, which consists in thoroughly cleansing with disinfectants the wound or wounds, and when abscesses occur freely opening them, and syringing the cavities out with some disinfecting solution (carbolic acid lotion 1—40), and see Formulæ 114 to 120, and afterwards dressing. Soiled dressings should be treated as already noted.

With regard to general treatment no certain remedy is known, but the following may prove useful. The diet must be nourishing, such as fresh green grass, fruits, wheaten cakes, gruels, and, though fever is present, rice or other grains should in these cases be offered, also stimulants such as rum, brandy, etc., and plenty of good drinking water.

Hyposulphite of soda, or sulphite of soda in 2-oz. doses every three hours, or small doses of calomel, say $\frac{1}{2}$ drachm, repeated every three or four hours. Euquinine may also be tried.

PUERPERAL SEPTICÆMIA.

This is an acute form of blood-poisoning following parturition, and is occasionally met with. The infection is due to minute organisms which gain entry through a wound or simple abrasion of the passage.

Symptoms.—These generally set in suddenly on the second or third day after calving. In two cases on the second day

the animals were said to have had no milk and would not have anything to do with their offspring. There was thirst, complete loss of appetite, considerable fever, hurried breathing, dulness, eyes lustreless, occasional moaning. In another case the symptoms started on the third day, there was suppression of milk but the mother was induced to take charge of the calf which was hand-fed. This animal suffered from severe abdominal pain, strained greatly and moaned frequently. No swelling, etc., was observed about the genital organs. The course of this disease is very rapid—two or three days—and recovery is exceptional.

Treatment.—Medicinal treatment is of little use, camphor and turpentine have been recommended, both troublesome drugs to mask the smell of. Alcoholic stimulants are beneficial. If the animal can be induced to permit it, irrigation of the womb twice a day with weak antiseptic lotions warmed to body temperature are recommended, such as carbolic acid or phenyle one per cent. For this purpose the elephant should be made to lie on her side and a piece of rubber tubing with a funnel attached may be used, or better still a garden syringe with tubing attached; the fluid should be injected slowly and gently; from 2 to $2\frac{1}{2}$ quarts is ample. If the elephant resents the operation the only thing then is to keep the parts clean externally by means of spraying lotion on them. When any symptoms of disease appear in an animal after calving, any pregnant animal or animals should be removed to a distance. Cleanliness is of vital importance; anyone handling a sick animal should be most careful to thoroughly wash and disinfect his hands. The standing should be kept scrupulously clean by firing the ground and sprinkling disinfectants on it.

Post-mortem examination.—The peritoneum shows blood spots here and there, the liver and kidneys are soft, the spleen soft and enlarged. The blood is fluid and not coagulated. The flesh has a half-boiled appearance. There are usually some blood spots on the surface of the womb and some exudation between its layers. In the womb itself there is generally some dark-coloured fluid.

CHAPTER III.

ANTHRAX.

Before considering the disease as it occurs in elephants, it will be advisable to discuss it as it affects some other animals. From numerous records of the disease and the heavy mortality reported therefrom, as well as its infectious character, we have learnt to consider it one of the most formidable diseases we have to encounter.

Definition.—A virulent infective fever caused by the entrance into the blood and tissues and multiplication therein of a micro-organism known as the “bacillus anthracis.”

The organism.—Is a large rod-shaped bacillus, smooth in outline, with square cut ends and easily stained by the basic aniline dyes. It forms spores only when exposed to the atmospheric air, *i.e.*, after the death of the animal. The spores are extremely resistant bodies, much more so than the bacillus, and are capable of producing the disease when they are taken into the system of an animal, *hence the importance of not cutting open animals dead from this disease.*

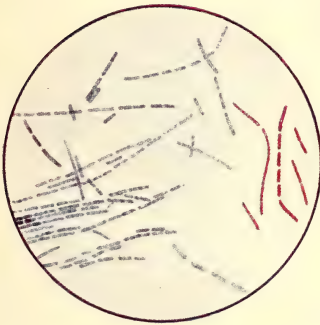
Incubation (that is, period which elapses between the time of entry of the organism into the system and the appearance of its first symptom).—In naturally acquired anthrax in elephants the incubation period is indefinite, as it is impossible to tell when the animal was exposed to the contagion. After the exhibition of symptoms of illness some die within an hour and others may live a week or more.

Prevalence.—Certain localities are peculiarly adapted to the development of the disease which recurs in them repeatedly, notably low-lying swampy districts subject to inundation, especially in hot and damp climates, with clay and loamy soils; some areas in these localities, particular pastures, are specially notorious for frequent outbreaks. From these localities the disease may be carried in various ways and infect extensive areas constituting epidemics.

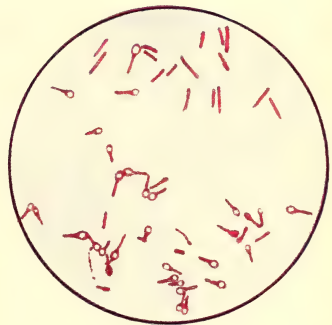
Season.—Outbreaks in Burma generally occur during April, May, and early part of June, *i.e.*, the advent of the rains, and September and October, the close of the rains. At these times there are heavy thunderstorms, often followed by intense heat.

Altitude.—It is rarely met with on any elevated well-drained land.

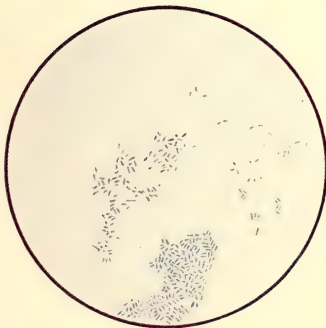
PLATE XIII.



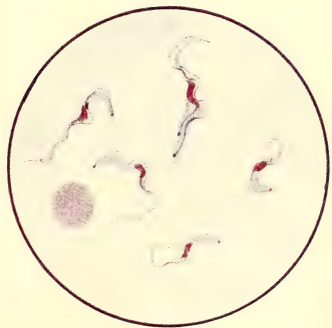
ANTHRAX.



TETANUS.



HÆMORRHAGIC SEPTICÆMIA.



SURRA TRYPANOSOMES.

Sources of infection.—Food, water and articles soiled by excreta, etc., of affected animals. Flies may carry the bacillus on their feet, mandibles, or may infect by means of their biting apparatus.

- (a) *Food.*—In the case of carnivora, the flesh of animals that have died of the disease.
- (b) In herbivora, fodder or water which has been infected by discharges from affected animals or carcasses.
- (c) *Respiration.*—The spores of the organism may be carried by the wind and thus taken in with air to the lungs.
- (d) Local wounds and sores may be infected by being brought into contact with the anthrax poison either through the discharges of infected animals directly, or through the agency of flies, or suctorial insects, that have either settled on infected material, or have bitten infected animals.

General symptoms.—The most characteristic features of the disease consist of the suddenness of the onset, accompanied with violent shivering or trembling, early pronounced prostration; the very aspect of the animal, which it is impossible to describe, but which once seen will not be forgotten, denotes the gravity of the seizure; fever, which rapidly becomes high, bleeding from the mucous membranes, evidenced by purplish spots and blotches on the mouth and palate, or by blood-stained discharges from the mouth, anus, or bladder. These symptoms run a severe and rapid course and are usually succeeded by a fatal issue in from one hour or less, to several days, according to the virulence of the poison, or more rarely may end in recovery. Over and above these ordinary symptoms may be seen those arising from local conditions:—

- (a) The lungs, shown by distressed breathing which may culminate in suffocation.
- (b) Intestinal colic, with often severe diarrhœa, attended with voiding of dark liquid or blood-stained evacuations.
- (c) Nervous system, in which spasms, wild excitement, extreme listlessness or insensibility, paralysis with tottering gait, and convulsions ending in death.
- (d) The skin. Rapidly formed swellings or tumours localized or diffuse beneath the skin which may either precede or succeed the advent of fever, and which are at first hot, painful and doughy, but later become cold and painless, and which on incision are found to contain a jelly-like material but never pus. The swellings are more frequently seen behind the jaws (parotid glands), between the limbs, groin, on the front of shoulders, belly, or hind-quarters; sometimes sores on the skin.

As regards the disease in elephants it will be sufficient to observe that all degrees of severity and diversity of symptoms may be met with. It frequently happens that the most virulent forms are encountered during the early period of an outbreak. Death sometimes ensues so rapidly without any symptoms having been noticed, that it has been attributed to apoplexy, heat-stroke, lightning-stroke and snake-bite. During the rains, when anthrax is prevalent, occasionally more or less sudden deaths are recorded in which the mouth, tongue and throat have been observed to be in a diseased state, and these symptoms have been attributed by Burmans to a black hairy caterpillar which is common at this season of the year in certain localities where it often does immense damage to teak and other trees. Burmans state that if an elephant takes up one of these creatures with its food death will result. In the same way similar cases in horned cattle have been ascribed to this caterpillar, but these are often cases of anthrax. I have handled the caterpillar and have not suffered except some slight irritation.

Prognosis.—Most unfavourable: Friedberger and Fröhner give the average mortality amongst domestic animals from 70 to 90 and even 100 per cent. in the worst types (*i.e.*, apoplectic). After an epidemic has continued some time the disease may assume a milder type and recoveries without any treatment are not unusual.

Diagnosis.—Though it is highly important readily to recognize anthrax, it is in reality often a most difficult matter owing to the variation in symptoms, or owing to a fatal issue arising without any definite symptoms at all having been manifested. Again, it is often difficult in dealing with isolated cases. When some of the more important symptoms enumerated above have been detected, there is less difficulty in pronouncing the character of the disease. Positive diagnosis can only be made by finding the anthrax bacillus in the blood by means of the microscope. If anthrax has been prevalent in a locality previously, and sudden deaths occurred among cattle at the same time as among elephants, or if elephants have grazed in places where carcasses are known to have been buried, the disease may reasonably be suspected to be anthrax.

When anthrax is suspected as a cause of death, slides or cover-glass preparations should be made and sent in at once for examination.

In connection with this it should be remembered that anthrax bacilli only invade the blood stream shortly before death, and that after death putrefactive organisms which closely resemble anthrax bacilli enter the blood stream from the bowels. Therefore in all cases, if blood cannot be taken either half an hour

before death or within an hour after death, it is generally useless making specimens.

Microscopical examination of the blood taken immediately before or shortly after death will afford a correct diagnosis. The disease will be best understood by quoting a few illustrative cases. Some of these occurred among elephants at the same time that this disease was raging amongst horned cattle in the same locality.

Case No. 1.—Red spots observed on the mucous membranes, eyes staring, passed blood with the excrement. During illness kept shivering and leaning against trees; after falling he did not rise again. Died on the second day of illness. Putrid smell from the mouth soon after death. Another animal had a short time previously died suddenly near by.

Case No. 2.—One morning an animal to all appearances well, was saddled, loaded and started from camp; she had only gone a short distance, when it was observed that she was not walking properly, *i.e.*, signs of weakness behind were evident; she suddenly stopped and refused to go on, so was turned to return to camp, but in a short time she fell down; the baggage and *kah* (basket) ropes were cut through at once but she did not rise again, dying in a short time. This elephant had a day or so before grazed over a place where the carcass of an elephant which had recently died had been dragged by two elephants for about a mile for burial.

Case No. 3.—Three elephants, namely, Nos. 100, 101, 103, were working in the same creek. These elephants had worked through the hot weather; they had a day off after every three days' work. Grazing was scarce; they lived chiefly on dry bamboo and were given a liberal ration of paddy daily. The drinking water was taken from shallow wells freshly made; the water however was described as putrid and offensive: and that in which the animals were bathed was stagnant. It had rained for a couple of days prior to the first elephant being attacked.

On the morning of the 5th May, No. 103 was noticed to be out of sorts, so was not sent to work; after receiving some medicine he was set free to graze. In the evening, when brought to water, he was observed to be much worse; he drank as usual, but his ears and body were cold, and he was very dull. His mahout took him into the jungle, and during the night he was observed to fall once and lie down several times; in the morning he was found standing alongside a clump of bamboo, looking very sick; his mucous membranes were yellow, trunk swollen, and he was unable to move; he dropped and died. This was on the 6th May. Cause of death supposed to be sunstroke, but proved to be anthrax.

The remaining elephants were thrown out of work, rested for a few days and were then moved to another creek.

Case No. 4.—On the morning of the 18th, No. 100 was found dead and was buried where he died. Death was reported to be due to anthrax. No signs of illness were manifested.

Case No. 5.—On the morning of the 23rd, No. 101 was found dead. This elephant was fettered, set free to graze the evening previous apparently well, and was found dead within a few yards of where No. 100 died.

Three elephants were stationed together, Nos. 9, 10 and 11.

Case No. 6.—No. 11 when seen on the morning of the 5th June was to all appearances well; he was let loose to graze. In the evening he was noticed to be very dull, trembling, ears cold, eyes bluish, appeared unable to see, did not obey orders, breathing very hard. In fifteen minutes or thereabouts his hind-legs suddenly gave way under him; he fell, was delirious, and soon died.

Case No. 7.—No. 10 had done no work for some months, as he was being treated for a sore; he was seen on the afternoon of the 6th of June leaning against a tree shivering; on inspection he was found to be dull, a swelling was observed behind the jaw, he took no notice of his keeper, and later on became delirious; his hind-quarters were weak; he tried to move away, but fell forward and soon afterwards died. In about an hour the body was noticed to be enormously distended. This elephant died at a place $1\frac{1}{2}$ miles distant from where No. 11 died.

Case No. 8.—An elephant which was apparently quite well the previous evening was next morning observed to be very ill: the ears and legs cold, body hot, breathing hard, trunk swollen, eyes staring; blood was noticed on dung that was passed; when made to move his hind-quarters swayed to and fro; he dropped, and died in convulsions. Soon after death the body became greatly distended and blood was observed passing from the natural openings. The rectum was everted, dark in colour, and presented the appearance of a tumour.

Case No. 9.—On the morning of the 10th October, the mahout went out to catch his elephant; on finding him he observed that the animal was sick, his breathing was distressed, there was swelling behind the jaws and also on the belly, and the trunk appeared swollen, especially in its upper portion; on trying to take the animal to water he seemed very weak. He was left under a bamboo clump. In the evening he was worse, was very dull, the trunk flaccid, breathing very audible. Next morning he seemed no worse, refused food, and, though he took water in his trunk, appeared to have some difficulty in swallowing. He died about 3 P.M.

Case No. 10.—On the 31st July this animal, while out grazing, was found in the morning standing perfectly quiet amongst some bamboos; he was made to move a few feet with difficulty, and it was noticed that he had a large swelling, called *thut* by the Burmans, extending from between the fore-legs on to the belly and sheath of penis; he was given water which he drank; during the day another small swelling was noticed on the hind-quarter; he passed some foetid liquid motions and also urinated in small quantities during the day; swellings were treated with mixture of turmeric, etc.—1st August.—No sleep during the night, ate and drank a little, passed liquid motions, animal very drowsy, listless, and stiff; swellings no better. 2nd August.—Died early this morning.

Cases Nos. 11 and 12 are quoted from Frost.

Case No. 11.—This is the third elephant that has perished at this depôt within twelve days. Case 1 died after a short illness. She was seemingly in perfect health on the evening of 14th June, and died about 3 or 4 A.M. on the 15th. I did not attempt a *post-mortem* examination, but merely examined the contents of the abdomen as removed from the body. In this case nothing attracted my attention save large abscesses in the liver, which I thought sufficient to account for death. Case 2 died on the 22nd; no *post-mortem* held. Case 3.—The following are the symptoms which were given to me by the sergeant in charge of the animal:—The first symptoms of sickness were noticed on the morning of the 23rd instant in the shape of a lameness of the front and hind leg, left side. During the day it refused all food (Colonel Hawkes corrects this and states it ate a little food); no sleep at night. On the 24th left side improved by fomenting with hot water. Refused all food, and kept lying down and getting up at irregular intervals throughout the day and night; slept very little and ate no food. Administered a purgative through the medium of plantains and boiled rice, which slightly acted on the system, the excrement being mixed with slime. On the 25th the animal grew worse; no sleep, no food, lying down and getting up till about 3-30 P.M. Appeared during the day to be in pain, as the animal was noticed sitting on its haunches and biting its trunk; passed urine once yesterday. At 4-30 P.M. it expired.

P.S.—During the day a large swelling formed behind the left ear.

With the exception of the P.S. I do not think there is much value to be attached to the symptoms quoted. Colonel Hawkes adds that the tumour formed very rapidly.

The symptoms which I noticed were not characteristic: pulse 68, pupils dilated to their fullest extent, breathing hurried, animal down and very uneasy.

Case No. 12.—The following symptoms were detailed by the sergeant in charge:—27th of June, 4 P.M., was observed to be limping when brought from shed to feeding-place; ate rice and straw; no sleep during night and ate very little. Favoured left hind-leg on account of pain. 28th of June.—Swelling on right of penis was observed early this morning; animal drags left hind-leg; ate *charah* freely from 9-30 to 10 A.M. Urinated at 9-45 A.M.; urine of whitish colour, but without pain; ate and drank and seemed better. 29th June.—No sleep during night; swelling increased; grew worse between 8 and 9 A.M. Tumour greatly enlarged since morning. At 9-10 A.M. lay down, biting trunk from pain. About this time Veterinary-Surgeon Frost opened the tumour. Elephant died at 10-10 A.M.

Case No. 13.—This elephant, No. 86, was taken ill at six o'clock on the evening of the 6th July 1906, when he stopped feeding. He was seen at 9 P.M. on that day, when he appeared to be suffering from very severe colic, for which he was treated.

The elephant was very dull, abdomen very much distended; he yawned a great deal, breathed very heavily, frequently put his trunk in his mouth, and swayed from side to side almost to the point of falling. His temperature at 9 P.M. was 99° F., but at midnight it had risen to 102·8° F.

The following is a record of temperatures taken daily during the animal's illness:—

Date.			A.M.	Tempera- ture.	P.M.	Tempera- ture.
6th	...	...	...	...	{ 9	99
7th	...	...	6	102·8	12	102·8
8th	...	...	6	102	6	102·8
9th	...	...	6	101·2	6	101·8
10th	...	...	6	101·8	6	101·4
11th	...	...	6	100·8	6	100·8
12th	...	...	6	99·6	6	98·2
13th	...	...	6	99·8	...	...

On the morning of the 7th, although the temperature was the same as the previous night, the elephant seemed to be better. He was not quite so dull and had stopped rolling his body from side to side. At 6-30 P.M. on this day he was distinctly better, and again commenced feeding, having been without food for over 24 hours. This improvement in the elephant's condition continued steadily until 5 P.M. on the 12th July, when he was again seized with very

severe colicky pains which, gradually getting worse, continued throughout the night and terminated in death at 9-20 A.M. the following morning, 13th July.

NOTES.—6th July.—Elephant had no food from 6 P.M. on this day until 6-30 P.M. the following day.

10th July.—Swelling appeared on neck, very slight and soft at first, but gradually getting larger, harder and quite insensible before death took place.

12th July.—Temperature, 12-30 P.M., down to 97·8° F. Urine very much discoloured; elephant seized with very severe colicky pains, 5 P.M.

13th July.—Colicky pains continued; 9-15 A.M. elephant fell down; 9-20 A.M. elephant died; 9-25 A.M. specimen of blood taken and examined under microscope.—Anthrax.

POST-MORTEM EXAMINATION.

If blood smears can be obtained shortly before or after death a *post-mortem* is unnecessary. Whenever possible it is best to avoid making one, as much harm is done by soiling hands, cloths, and the surrounding ground—a most important matter in connection with this disease.

In all cases in which an animal has died or been found dead from some unknown disease it should be remembered that before undertaking this operation no attendants on healthy animals should be permitted to handle the carcase or instruments. Some persons who are not likely to come in contact with healthy animals should be selected, and in Burma at least there is no difficulty about this. The men chosen must be inspected carefully, and no one with abrasions or scratches, however trivial, should be permitted to take on the work. They should be made to rub themselves with carbolic oil (1 to 20), and solutions of carbolic acid (1 to 40), or even stronger, should be at hand to cleanse without delay any cut or wound which may occur accidentally. Any such cut must be dressed and the man forbidden to continue work.

After the operation the men engaged must be made to wash their bodies, and especially their hands and feet, with carbolic lotion (1 in 60 or 70) or weak phenyle lotion. Any clothes worn by them had better be burned and their scanty wants in this direction renewed by the employers. All instruments used must be washed in carbolic lotion (1 in 40) and boiled before being restored to their cases. And here I may remark that all instruments employed in any *post-mortem*, whether anthrax or anything else, must be kept locked up,

and on no account be made use of in any surgical case, as for instance, opening an abscess. Care must be taken not to scatter organs or blood about the place, but to restrict the area infected to the smallest limits. A very deep pit should be prepared alongside and the carcase tumbled in. The soiled area should be well sprinkled with carbolic powder or other strong disinfectant, the ground dug up and thrown into the pit, a thick layer of straw should then be spread all over the ground and fired. The area should be strongly fenced in.

The belly is usually greatly inflated, bloody discharge may be noticed from the natural openings, decomposition sets in rapidly, swellings may be present beneath the skin.

The blood is of a dark, tarry and fluid character, often staining the cavities of the heart and interior of the blood vessels a peculiar red tinge. Any of the organs or all, namely, liver, spleen, kidneys, lungs, brain, may be found engorged with blood, and their substance softened, and *the spleen especially is usually found enormously enlarged*. In one case it weighed $62\frac{1}{2}$ lbs. The cavities, that is, the abdomen, chest, heart-bag, and cranial, may contain blood-stained fluid, and the lining membranes have scattered over them purplish blood spots or blotches. The bowels may be thickened, their contents bloody, and the lining membrane scattered over with purplish blood spots or patches.

The tumours above referred to consist of a yellowish greengage jelly-like material, which may have a dark centre and may be found in other parts, notably in the mesentery, or membrane connecting the bowels to the spine, around the kidneys, furrows of the heart, about the throat and other places, and when present may be taken as very indicative of anthrax.

The following cases are recorded by Frost:—

“*Post-mortem* on an elephant belonging to the Commissariat Department, Rangoon. Died at 4-30 P.M. on the 25th of June 1878, after an illness of two days.

“Body well nourished and muscles of healthy hue. On removing the right fore-limb, my attention was at once drawn to the peculiar jelly-like deposit found in cases of anthrax. This deposit existed to a considerable extent in the connective tissue of the chest, muscles, and between the shoulder-blade and the ribs. In parts the deposit was of a yellowish white, and in others of a rosy hue.

“Before commencing my examination of the body, and when conversing with Colonel Hawkes, Executive Commissariat Officer, I was told that amongst other symptoms exhibited by the animal was a small tumour in the region of the left parotid gland. I had the body turned in order to examine the tumour. On removing the

skin covering the enlargement, a true anthracoid tumour presented itself. The same jelly-like exudate occupied a space of about 8 inches by 6 inches.

"The blood in the veins was of a dark, tarry consistence and colour, and in almost all the veins a certain degree of coagulation had taken place. Only the normal quantity of fluid in the abdominal cavity. Peritoneum healthy, mesentery congested. Spleen of a dark colour, with considerable bloody spots and blotches all over its surface. The same deposit alluded to before existed between the layer of membrane attaching it to the stomach. On removing the spleen from the body I found it weighed $37\frac{1}{2}$ lbs. On cutting into its structure, and on withdrawing the scalpel, the blade had adhering to it a thick layer of blood as dark as ink. The gland could easily be broken down by pressure of the finger.

"On the under surface of the stomach, close to the pyloric orifice, I found a patch of the size of a dinner plate consisting of the same kind of deposit as I noticed in the tumour. In the tissue under the loins I also found the same thing to exist. Above the penis another large tumour was found.

"Intestines and kidneys healthy. There was a slight deposit in the substance of a lung which, to a certain extent, blocked up the bronchial tubes. A large quantity of frothy mucus was found in the windpipe and large bronchi, yet there was no symptom of breathlessness noticed before death.

"On laying open the pericardium (bag of the heart) my attention was arrested by the large quantity of fluid which was contained in the sac. From a careful but rough calculation, I came to the conclusion that it contained from 35 to 40 ounces of serum, possessing more the colour of venous blood slightly diluted with water than true serum. The external surface of the heart presented a peculiar appearance. Intensely dark blood spots studded its surface—some of the size of a rupee, others the size of an eight-anna piece, and others still smaller; these were particularly numerous on the right auricle.

"The horizontal and vertical grooves of the heart were filled with peculiar jelly-like deposit. Large clots in right heart and pulmonary artery and none in left. Although it is a remarkable fact that in anthrax the blood is generally found in a fluid state, I did not find this to be the case in the present instance. There was no unpleasant odour from the body, although the *post-mortem* did not take place until fifteen hours after death."

These are the leading *post-mortem* appearances noticed by me :—

Post-mortem No. 2 on an elephant that died at 10 A.M., 29th of June 1878, after two days' illness. Body examined seven hours

after death ; in good condition. On each side of the penis, about the region of the scrotum in other animals, I found two large tumours of the true anthrax character. Further, with the exception of the intestinal mucous membrane I did not notice anything peculiar. The mucous membrane of the intestines was highly congested. The blood in the vessels was fluid. Spleen weighed 24 lbs., liver $61\frac{1}{2}$. I saw this animal at 9-30 A.M. (while still alive) and examined the tumours. They were cold as ice, and on cutting into them no pain was exhibited by the animal, nor did any discharge take place subsequent to the incision being made. Once I saw the nature of the effusion, I had no doubt of the result, which was death soon after.

Treatment : Preventive.—From the above remarks, especially with regard to infection and contagion, easy transmission to man, and high mortality, it will be readily grasped how dread and important is the nature of the disease, and from the fact that no specific remedy has been discovered of any avail in treatment, it follows that the most important way to combat the malady lies in prevention. Precautions therefore such as have been discussed in Chapter I should be carefully observed.

Vaccination.—Having been questioned so frequently with regard to vaccination I have mentioned the subject in detail more for information than with any intention of recommending it. By the practice of protective vaccination the heavy mortality has in certain countries, France, etc., been reduced to less than one per cent. Two inoculations are necessary. The first is a weak vaccine. This is followed in from twelve to fifteen days by a second, which is stronger. The *second* vaccine matter must *never* be used before the *first*, for the *second* might kill unless the animal had been protected by the *first*.

The vaccinal liquid is sent out in glass tubes, sealed by rubber stoppers, and bear labels "First vaccine matter" or "Premier vaccin charbonneux," usually a red label, and "Second vaccine matter" or "Deuxième vaccin charbonneux," white label. A note is printed on the second vaccine label to the effect that it should be employed twelve days after the first. The vaccine is introduced under the skin by means of a Pravaz or other special hypodermic syringe; behind the ear is about the best place to inoculate an elephant. The elephant having been made to assume the recumbent posture, the hands of the operator must first be thoroughly washed with soap and warm water, and then disinfected, as also the site selected for inoculation ; this completed, a portion of the skin is to be taken up between the thumb and forefinger of the left hand, the needle carefully introduced beneath the skin and the contents of syringe

injected without force. The metallic wire is removed from the needle and the latter adjusted on the syringe, or the needle may be introduced first and syringe adjusted after. After the contents of the tube have been well shaken the stopper is removed and the required amount withdrawn. Care must be taken to see that the syringe is working properly. Air bubbles may be removed by holding the syringe upright and gently pressing the piston till a drop issues from the needle. The second inoculation should be made on the opposite side. It is a matter of vital importance that the vaccine be introduced in a pure state; for this reason, if a tube be opened, the contents must be used forthwith. If the whole contents cannot be employed at once, the portion remaining must be dispensed with. It is of equal importance that the syringe be absolutely clean. New syringes are generally safe enough, but one that has been used must be cleaned before and after the inoculations are performed. In order to effect this, the syringe is taken to pieces, placed in water, and boiled in it for five or ten minutes. Immediately before use it is as well to draw up some absolute alcohol: this will render syringe and needle sterile. Cheap and easily sterilized syringes are procurable from most instrument makers. If the vaccine be not *pure*, or the syringe not *clean*, foreign organisms may be introduced, which may render vaccination ineffective, or what is still more serious may give rise to virulent blood-poisoning.

Every care must be taken to see that the *first* vaccine is properly introduced under the skin; for if this operation be performed hurriedly or carelessly no protection will be afforded and death may result after the introduction of *second* vaccine.

There is no denying that vaccination is attended with certain risks, owing to defects in the operation, quality of the vaccine employed, and susceptibility of individuals. In *sheep and cattle* vaccination has in some cases resulted in death; in others serious illness, swellings, have followed the operation.

On the Continent the accidents vaccination gives rise to are said not to be so frequent as to cause much alarm. Generally speaking, the animals inoculated become sufficiently protected to resist natural and even experimental infection. It is stated that *vaccine sent to a long distance is not easy to preserve*, and in order to obtain really good results it must be used as soon as possible after preparation.

Firms having an interest in or owning a large number of elephants and desirous of trying experiments should make some arrangement by which they could, on despatch of telegraphic order, be supplied with fresh vaccine, syringes, etc. All information and appliances can be obtained from the Director of "The Société du Vaccin Charbonneux Pasteur," 14, Rue des Pyramides, Paris.

Arrangements can be made for each tube to contain sufficient vaccine for one elephant. The price of a dose of first and second vaccine is, I believe, 4*d.* to 6*d.*

With reference to vaccination in sheep and cattle, Koch has noted the following points :—

- (a) That if the vaccines are too strong, they may cause fatal charbon (Anthrax).
- (b) If they are too feeble, they do not protect.
- (c) That they do not confer immunity without rendering the animal seriously ill, and that they are consequently dangerous.
- (d) That vaccination may serve to disseminate by rendering animals severely ill from that disease, during which illness they are capable of infecting others.
- (e) That the immunity conferred is insufficient to preserve with certainty from natural infection.
- (f) That the immunity conferred is of too short duration.

Protective vaccination against anthrax amongst elephants was tried in Burma during the early eighties. Unfortunately the records regarding the experiments are very meagre; from those available I find that my predecessor, at the request of the Conservator of Forests, Pegu Circle, inoculated two Government elephants (one full grown and one young animal) on the 7th September 1883, also two cow calves, one buffalo calf, two sheep, one pony and a pig, with Pasteur's first vaccine. The temperature of these animals, with one exception, a sheep, was slightly affected, the sheep showing a rise died on seventh day after inoculation from anthrax. On the 23rd the second vaccine was injected. None of the animals showed a rise in temperature over one degree. One elephant had a swelling at seat of inoculation, the elephants were removed to jungle on tenth day after inoculation. The Conservator of Forests would not agree to the proposal to test the efficacy of the inoculation by inoculating with virulent anthrax virus, owing to the great value of the animals. The pony, sheep and pig were inoculated and no ill-effects followed; two unprotected rabbits inoculated with same material died of anthrax within 36 hours. On the 2nd May twelve elephants, the property of contractors, were inoculated at Zigôn with first vaccine.

On the 15th only nine elephants were brought forward: they each received an injection of second vaccine. One elephant had a swelling at seat of previous inoculation. I regret I cannot trace the further history of these animals.

I believe that the Bombay Burma Trading Corporation inoculated many elephants about the same time, and from what I

have heard the results were not encouraging, so much so that no further inoculations have been carried out since.

Curative treatment.—Carbolic acid in 2-dr. doses, well diluted with oil or warm water, is perhaps beneficial in the few cases of subacute type in which its administration is possible. The doses should be given at intervals of two or three hours. Cyllin or medicinal Izal in similar doses may also be used.

Other methods of treatment have been advocated, from which I have selected those considered likely to prove best which I append :—Hyposulphite of soda 4 to 6 ounces mixed with jaggery, two or three times a day, or carbolic acid 2 drachms, glycerine $\frac{1}{2}$ an ounce, added to two pints of water, twice a day, or pure iodine $\frac{1}{2}$ a drachm, iodide of potash 2 drachms, mixed with jaggery may be given twice a day. If the animal cannot be persuaded to take these, the rectum should be emptied by hand and an enema of carbolic acid 2 drachms, glycerine 1 ounce, warm water 4 pints, injected every four hours. Also hypodermic injection—carbolic acid 1 drachm, glycerine 1 ounce. A small incision should be made through the skin and the needle inserted.

The tumours should be cut into deeply and extensively by a cross incision, freely cauterized with pure carbolic acid and dressed with carbolic lotion (1 in 40), and on redressing the soiled dressings must be placed in a receptacle (never on the ground) and burned under supervision. The receptacle must then be thoroughly cleansed with carbolic solution (1 in 40).

NOTE.—The disease is not infrequently met with in horned cattle. The vernacular names for it are—ဒေါင်းသန်းနာ (*Daung-than-na*) ; ဂြိုဟ်နာ (*Geik-na*) ; ဟောက်နာ (*Hauk-na*) ; ဆုံဆို့နာ (*Sone-so-na*) ; လိင်နာ (*Yine-na*) ; အောင်နိုင်နတ်တန်း (*Oung-nine-nat-pan*) ; မှင်သတ် (*Hmin-thet*). As the disease is so difficult to separate from Hæmorrhagic Septicæmia, the Burmans no doubt apply the names to both diseases.

Symptoms.—As is the case with elephants the disease may be met with in the internal or external form. In the former death may occur quite suddenly without noticeable symptoms. When symptoms are present they are an anxious expression, muscular twitching, discharge from nostrils, sometimes blood-stained, the animal is blown out, there is often abdominal pain and straining, the dung is blood-stained and the urine high-coloured. The gait is staggering. The mucous membranes are high-coloured and there is high fever. In some cases the animals appear frenzied ; this stage is soon succeeded by marked stupor. In the external form fairly hard, doughy, painful, circumscribed swellings which pit on pressure occur about any part of the body but more often about the throat, neck, shoulder, back and abdomen. The swellings tend to become quite cold and painless. Cold, diffuse, painless swellings under the skin may be observed in some cases. The external form is less fatal as a rule.

CHAPTER IV.

HÆMORRHAGIC SEPTICÆMIA.

When examining the blood of elephants suspected of having succumbed to anthrax, Mr. Cameron, C.V.D., myself and others have seen the organism of this disease which in all probability is far more common than we imagine. The symptoms so closely resemble those met with in anthrax that a mistaken diagnosis is an easy matter. By means of a microscope the diagnosis is rendered easy, as the organisms are very different.

Definition.—The disease is a virulent infective fever caused by the presence of an organism which is small in size, ovoid in shape and on staining often presents only the terminal portions coloured, the intervening portion being unstained.

As in anthrax, sporadic cases may be met with at any season, but generally speaking the disease is most prevalent during the early rains or towards the close of the monsoon. It may be met with after any unseasonable rain, but is most common on low-lying lands subject to periodical inundation and on those which may be submerged by extraordinary floods.

Duration of attack.—From a few hours to thirty-six hours. Animals that live beyond this—and they are few—have a chance of pulling through. The disease is in some cases so rapidly fatal as to be mistaken for snake-bite. I fear much time is spent and wasted very often in hunting for “fang marks.” Animals may die so rapidly as to preclude the appearance of the more prominent symptoms. As in anthrax, outbreaks do not usually last long—ten to fifteen days. The mortality is very high.

Infection.—In elephants the main channel of infection is generally through wounds, abrasions, etc. The nature of their food is such as to frequently cause wounds and abrasions about the lips and mouth in addition to those they may acquire about the limbs, trunk, feet and body by sharp bamboos, thorny bushes, stumps, etc., while grazing in the jungle. The virus may also gain entrance to the system through abrasions in the lining membrane of the digestive tract by means of infected fodder, water, etc.

Symptoms.—The general symptoms are complete loss of appetite, frequent yawning, mouth being usually kept open, the trunk contracted or shrunken-looking, trembling, high fever and the

appearance of a swelling or swellings of variable size diffuse or circumscribed in different parts of the body. These swellings are most frequently met with in the head, between the jaws, in the neck, on the shoulders or immediately behind them, sometimes under the abdomen and tail and also in the groin. The area most frequently affected is perhaps the throat region, and in some cases the swelling may be so extensive as to involve also the face, trunk and neck, causing marked disfigurement. The swellings under the tail often attain a considerable size and may spread downwards between the hind-legs and along the under surface of the abdomen. When they first appear the swellings are hot, doughy and painful, later becoming hard and tense. In those cases in which the throat is affected the respirations are increased in number and are laboured and difficult, and as a rule noisy. The respiratory difficulty is very acute towards the end and death may take place in convulsions from suffocation. When the limbs are affected lameness is often manifested. The tongue may appear swollen and dark in colour. The cavity of the mouth may be dry or may be coated with a sticky saliva. The palate may also appear dark in colour, with mulberry-coloured spots. A discharge of a slimy material from the trunk may also be observed. In some cases vomiting may occur. All mucous membranes are of a diffuse red colour, with generally mulberry-coloured (hæmorrhagic) spots. The bowels are usually not much disturbed, though the passage of dung is often preceded or followed by a discharge of liquid, dark, fœtid material, which sometimes contains mucus and traces of blood. Diarrhœa may be present in some cases. The urine is scanty, high-coloured and turbid. The internal temperature is always high, but the surface temperature of the body is variable. In acute seizures there is in some cases vomiting, loss of power behind, evidenced by inability to move, in others a staggering gait with a tendency to fall forwards may be observed.

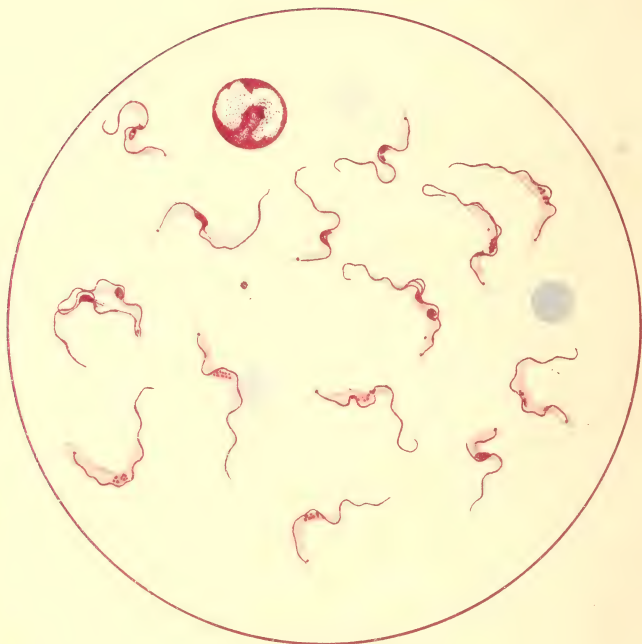
Treatment.—No treatment is of much use. Good nursing, *i.e.*, attention to the animal's wants, frequent stimulants such as rum, whisky, country spirit, etc., diluted with water or gruel, or mixed with treacle and water in a bucket, if he can be induced to take them, are most useful. The mouth should be frequently washed out with some mild lotion, *e.g.*, alum, boracic, or dilute Condyl's fluid. Serum is being tried in cattle and other animals for the prevention and cure of this disease with I believe a certain measure of success, and might when perfected be tried in elephants with an equal chance of success where opportunities for its use occur. The great disadvantage of all sera in warm climates is their tendency to rapid deterioration and uncertainty of action. Pillules of a vaccine for this disease are now being tried.

Post-mortem appearances.—In acute cases all that may be met with is a slight excess of fluid in the body cavities, a slight redness of the peritoneum and some small hæmorrhages. The swellings are hard, and on section are found to contain a greenish yellow or at times pinkish gelatinous material, infiltrated with blackish hæmorrhages of various sizes. This gelatinous material may also be met with in other parts of the body infiltrating the connective and muscular tissues. On opening the abdomen an excess of fluid is found, the peritoneum, mesentery, etc., are highly injected and in some cases show hæmorrhagic points. The liver is often enlarged, full of blood and friable, as also the kidneys, which are soft. *The spleen is congested, friable and sometimes enlarged, though not to anything like the same extent as in anthrax.* The stomach shows hæmorrhagic patches both externally and under its lining membrane; the mucous membrane of the bowel shows hæmorrhages and inflammatory exudations, particularly about the duodenum, and may contain soft albuminous matter varying in colour from yellow to grey and streaked with blood. Lungs are congested and full of frothy material. Pericardium contains clear serous fluid and may show hæmorrhagic patches, the heart muscle is soft, friable and with hæmorrhagic patches; this may also be seen under the lining membrane of the heart cavities. The blood is dark-coloured and clots badly, but is not tarry as in anthrax.

NOTE.—This disease is met with frequently in horned cattle, especially buffaloes. The vernacular names for it are ဝဉ်းချောင်းကွဲနာ (*Le-gyaung-kwe-na*) and ဝဉ်းချောင်းပိတ်နာ (*Le-gyaung-pate-na*).

Symptoms.—Are very much the same as those already described in the elephant.

PLATE XIV.



TRYPANOSOMES IN ELEPHANT SURRA.
Magnification 750.

CHAPTER V.

TRYPANOSOMIASIS—"THUT"—ELEPHANT SURRA.

It is desirable to mention here a disease only too well known to all elephant owners by the Burmese name *thut* (ထုတ်). A large number of the sudden deaths occurring in elephants when not attributed to snake-bite fall under this heading. After most careful observation and enquiry I arrived at the conclusion that the term appears to be restricted to such cases of disease in which dropsical swellings appear as a symptom. In cases of *surra* in equines they are diagnosed as fever by the Burmans until some swelling either of the limbs, sheath, etc., is evident, then the cases are designated *thut*. It is therefore a term applied merely to any ailment in which swellings are present, hence many diseases might be included under the name, but as perhaps in a fair percentage of cases, especially in equines, the cases are *surra*, I have retained the name to apply to this disease only.

The actual meaning of *thut* is သွေးစုဆောင်း၍ပုပ်ဆွဲသည့်သွတ်နာ "blood that collects and tends to putrefaction."

It is probable that some of the cases called by Natives of India *zahirbad* are cases of *surra*.

Surra is a Hindustani word, meaning rotten.

Susceptible animals.—*Surra* affects equines principally, but the disease affects camels, dogs, cats, monkeys, goats, sheep, cattle and elephants.

In equines it is invariably fatal. Many cattle after considerable loss of flesh recover. With regard to the elephant not very much is known, but there is every reason for thinking that many elephants do recover, at any rate we are aware that the trypanosome disappears from the peripheral circulation, at least for considerable periods, whether relapses occur afterwards I cannot say in the present state of our knowledge. In elephants as in camels the disease appears to run a chronic course.

Definition.—A pernicious anæmia characterised by remittent or intermittent fever, wasting, although the appetite is good, dropsical swellings in dependent parts of the body, great weakness and finally paralysis, and caused by the growth and multiplication in the blood of an organism.

The parasite.—On the examination of a stained specimen we find it composed of a body which is usually described as eel-like in form, and inside the body two other bodies or nuclei, one of large size and usually situated about the middle of the organism, the other smaller and situated about the posterior extremity. Along one edge of the body runs the flagellum which arises from the small nucleus and is prolonged beyond the anterior end as the free portion. Connecting this flagellum to the body we have a very fine membrane, the undulating membrane. When examining a fresh specimen of blood, the trypanosomes can be seen wriggling rapidly from place to place and knocking the red corpuscles about with their flagella. There may be many parasites in a field or only very few.

Prevalence.—The disease occurs practically throughout India, Burma, Persia, Siam, the Straits Settlements, Philippines, etc.

Symptoms.—The disease “is characterised by an intermittent, remittent, and sometimes a relapsing type of fever which continues for varying periods, from a few days to months, according to the species and the constitutions of the animals attacked.”—(*Lingard*.)

In elephants it is very rarely that Europeans observe the early symptoms of any ailment—at least such as may be detected by an attendant who has had an animal under his charge for some time, such as slight dulness and fever, perhaps temporary loss of appetite, the animal doing his work but tiring rather quickly, gradual but scarcely perceptible loss of condition, alteration in character of the excretions.

Admitting a mahout to have noticed that his charge is not as well as usual, he might not report the matter, as many of them remember the old custom which prevailed, *viz.*, that while an elephant was out of work through sickness his driver was without pay.

Elephants become dull, listless and sleepy-looking, they are disinclined to move about and, if made to, the movements are sluggish, the eyes appear dull and dim, and there is in some cases a frothy discharge from the eyes. The mucous membranes are as a rule very pale and later may take on a yellowish tinge; there may be mulberry-coloured spots on them, but these are not constant. The bowels are generally normal, but there may be constipation and the dung covered with mucus. The urine is scanty, gradually becomes viscid, and is often markedly greenish in colour. Gradual but progressive loss of condition is usually present, but is not appreciable in these immense animals, at least to a casual observer, until pronounced.

During paroxysms the pulse is faster, and during the intermissions is about normal; as the strength fails it becomes feeble. The respiration is not much altered. Even though the temperature be high the appetite remains good—a remarkable feature

about this disease. Notwithstanding that an animal will take his food well throughout the disease, he gradually and steadily loses condition and strength. The blood undergoes profound changes, thus seriously interfering with proper nutrition of the tissues. Accompanying the debility and prostration of strength, though not constant, there may be dropsical swellings which may appear between the jaws, lower parts of abdomen, chest, or the feet or limbs may be swollen.

When daily observations of the temperature and microscopical examinations of the blood can be made it will be found that, even with a slight rise or no rise in temperature, trypanosomes may be found in the blood. From the notes on cases in my possession the temperature rarely rises to 102° F. During intermissions it may occasionally be found subnormal. The animals are dull and heavy during the paroxysms.

Diagnosis.—If an elephant be found showing symptoms such as described, *surra* may be suspected; positive diagnosis however depends on the demonstration under the microscope of the trypanosome in the blood. It may be necessary to examine blood smears daily for some time before a positive diagnosis can be established.

Incubation.—The onset is insidious and the incubation period is therefore not definitely settled, authorities having found different periods of time to elapse between inoculation and the onset of symptoms. The period seems to vary roughly between three and thirteen days in the horse.

Mode of infection.—In his "Surra Report, 1899" Lingard states that natural infection may occur in the following ways:—

- (i) By ingestion of grass from lands subject to inundation.
- (ii) By drinking stagnant water.
- (iii) From bites of certain species of flies.
- (iv) The ingestion of corn, etc., contaminated by the excrement of rats.

In 1901 Leonard Rogers pointed out that the horse-flies of India were capable of producing the disease in other animals after having recently bitten infected animals, and he therefore argues that the latent cases in cattle, buffaloes, etc., may thus act as sources of infection.

The flies blamed for the spread of *surra* belong to the Tabanidæ (*hmet*, ເມັດ) and *Stomoxys* (*yin-ye*, ເອີນຢາ), though perhaps other blood-sucking flies may also carry the disease.

Duration of disease.—The disease is divided into paroxysms and intermissions; the periods of intermission in the elephant may be of considerable duration. The paroxysms last from two to several days.

Dr. A. Lingard, late Imperial Bacteriologist to the Government of India, experimented on two elephants as to their susceptibility to equine *surra*. The conclusion he arrived at was that old Indian elephants in health are either insusceptible or only very slightly susceptible. In carrying out these experiments he injected subcutaneously in large doses virulent blood containing "Trypanosoma evansi" in numbers.

I am indebted to Captain J. D. Holmes, C.V.D., now holding the above appointment, for the following note on these experiments.

One elephant inoculated with 20 c.c. of blood drawn from the jugular vein of a control pony and kept under observation for about four months did not show any organism in the blood and was then discontinued.

The second elephant inoculated with 500 c.c. equine *surra* blood defibrinated, showed few organisms on the fourth day after inoculation, and these continued for six weeks.

The following numbers of Paroxysms and Intermissions were observed :—

		Length.			No. of Organisms.
1st P.	...	Six weeks	...	...	Few.
1st I.	...	Three days	...	...	—
2nd P.	...	Nine days	...	...	Few.
2nd I.	...	Two days	...	...	—
3rd P.	...	Four days	...	...	Few.
3rd I.	...	Six days	...	...	—
4th P.	...	Sixteen days	...	...	Few.
4th I.	...	Two days	...	...	—
5th P.	...	Six days	...	...	Few.
5th I.	...	Four days	...	...	—
6th P.	...	?	...	...	Few.

The observations were discontinued and later on the animal was disposed of in good health, without any visible effects of the disease.

Post-mortem.—Body generally much emaciated; on opening the abdomen a considerable quantity of straw-coloured fluid may be observed. The internal organs are pale in colour, *i.e.*, more or less bloodless. The liver, also spleen, is sometimes enlarged, dark (claret-coloured) spots or patches are often present on surface of the latter organ. The kidneys are often enlarged, congested and blotched with dark-coloured spots. In mules and ponies in Burma we frequently notice that the mucous membrane of the stomach is ulcerated and stained a peculiar yellow, in fact there may be a general tinge of yellow all over the membrane. In the chest we find heart pale, often flabby, and there is usually a quantity of straw-

coloured jelly-like material about the base, and beneath the lining membrane blotches and dark-coloured spots may be seen. They are also to be seen beneath the internal lining membrane of the heart.

Treatment.—Arsenic is the only drug that has proved of service in this malady. Commence treatment by giving 4 grains twice daily, the quantity of arsenic should be increased by half a grain every second or third day till 12 grains per diem is reached, when the dose may be decreased daily by half a grain until 2 grains is reached. If the patient shows intolerance of the drug manifested by loss of appetite, weeping from the eyes, partial loss of power in hind-quarters, evidenced by unsteady gait, nervousness, the medicine must be discontinued. Liquor arsenicalis is the most convenient preparation, each ounce contains *four* grains of arsenic and as it is tasteless it is easily administered in sweetened gruel. The medicine should be given *after* the animal has taken some food.

Within the last few years several methods of treatment have been tried with varying success, the most promising up to date being what is known as the "atoxyl" treatment. Atoxyl is a preparation of arsenic with an organic acid of complex composition. The theory of the treatment is that if ordinary preparations of arsenic are pushed one quickly observes symptoms of poisoning, but the compound atoxyl can be given in doses exceeding by several times the dose of arsenic it is possible to give. Still more recently Captain Holmes, C.V.D., in India, in experimenting with atoxyl and orpiment obtained most satisfactory results. The matter is still more or less in the experimental stage, and time alone will show whether or not the method can be extensively employed as a permanent cure in cases of trypanosome affections.*

Prevention—Is difficult, but the following suggestions are made :—

- (1) Avoid camping in marshy localities in the neighbourhood of which the disease is of course most common.
- (2) Protect the animals from the bites of flies when they are prevalent, by means of smearing their bodies with some weak mixture containing some tarry preparation or evil-smelling drug and by burning refuse about camps.
- (3) Prevent certain flies from breeding, by attending carefully to the proper disposal of manure and refuse about standings and in camps.

* Later reports have been so encouraging that this method of treatment will probably be generally adopted.

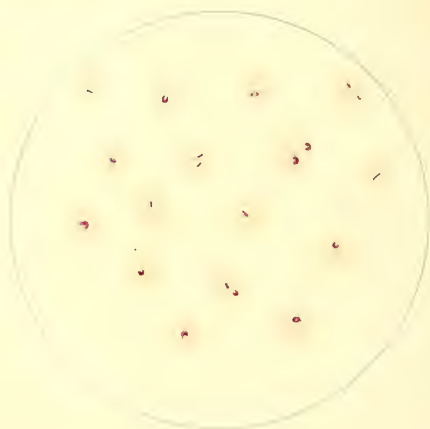
- (4) March the animals at night through country known to be infested with flies.
- (5) Isolate sick animals and protect them from the bites of flies.
- (6) A course of arsenic in any form at the beginning of the rains may be tried.

NOTE.—*Surra* has been described at some length. Further information on this disease is solicited. As much light can be thrown on the subject I appeal to those gentlemen in charge of large numbers of elephants in the districts to keep a sharp look-out on all cases of fever, especially if accompanied by debility, swellings, or both. *Careful daily observation of the temperature* will prove of assistance in suspicious cases, and I shall be pleased to receive early information of any outbreak of intermittent or remittent fever amongst elephants (see Appendix H).

PLATE XV.



PIROPLASMA (CATTLE), LARGE FORMS.



PIROPLASMA (CATTLE), SMALL FORMS.

CHAPTER VI.

PIROPLASMOSIS—TICK FEVER.

Piroplasma are small parasites of varying shape which invade the red blood cells. In some animals they are often pear-shaped, hence the generic term applied. The disease is conveyed by the bites of infected ticks. As far as elephants are concerned, there is practically nothing known.

In cattle in the acute form the symptoms are high fever, urine tinged with blood in most cases, also jaundiced membranes, anæmia, staggering gait, nervous symptoms, or even paralysis. In some cases we meet with constipation followed by diarrhœa in which there is a considerable admixture of blood. In the benign form there is an absence of bloody urine and jaundice, but there is often marked anæmia.

I am indebted to Mr. Hepburn for notes on the following case, which is of interest.

The animal in question was a young tusker resting during the hot months.

For some days previous to the 5th June, he had been noticed to be unwell, gradually becoming worse.

On this date, the bowels were constipated, and the urine very dark in colour.

On the 6th, Mr. Hepburn saw him and he suspected *surra*. The animal was dull, greatly run down, he could hardly stand. Pulse 56, temperature 98·8° F., mucous membranes of eyes very deep yellow. The bowels were constipated and urine of a dark red colour. The animal refused food.

Moderate doses of epsom salts were ordered and blood smears taken for examination.

June 7th.—Examination of blood smears proved negative. The animal appeared a trifle brighter and was inclined to take a little food. Condition of mucous membranes was the same. Pulse 50, temperature 98° F. Dung was reported to have been passed, also urine which was said to be lighter in colour. Steps were taken to attend to the state of the bowels.

June 8th.—Feeding is little better, bowels regular, membranes a trifle clearer, temperature normal.

June 9th. }
June 10th. } Absent from camp.
June 11th. }

June 12th.—Taking a little food, but dull, membranes dark yellow, temperature 98.4° F., pulse rate raised. Blood smears taken. Piroplasma found, but very few. Treatment—quinine and arsenic.

June 16th.—Under above treatment, the temperature went down gradually, though a few piroplasms were observed daily.

June 17th.—Temperature 98.2° F., slight constipation, urine very turbid.

June 23rd.—A few piroplasms have been seen daily in blood smears; the animal, however, appears stronger and is feeding better, but is very far from well.

On this date Mr. Hepburn had to leave camp, but in writing on the 16th July he states, "I have not seen the elephant since the 23rd, but understand he is progressing favourably."

The intermediary host of the piroplasm, a tick, has not been identified. Unless careful search is made about the inside of the thighs, etc., small ticks are very easily overlooked.

CHAPTER VII.

APHTHÆ EPIZOOTICÆ—FOOT-AND-MOUTH DISEASE.

ELEPHANT-POX.

FOOT-AND-MOUTH DISEASE.

The disease, as far as I can find out, was described first by Gilchrist* of the Hoonsoor Cattle Dépôt. During the Afghan campaign Inspecting Veterinary-Surgeon Oliphant† experienced a severe outbreak among the elephants under his charge; he describes it as a severe disease, one animal died from irritative fever, and in several it led to shedding of the hoof-slipper.

Causes.—Always due to contagion from cattle or other infected animals. The virulent material is carried by saliva and all secretions and excretions. The causal agent has not yet been discovered microscopically.

Period of incubation.—Thirty-six hours to three or four days.

Duration.—In simple uncomplicated cases ten to twenty days; in severe cases two or three months, or longer.

Prognosis.—Good, except in very young animals.

Symptoms.—The first symptom usually attracting attention is that the animal, according to the soreness of the mouth and degree of fever present, is partially or wholly “off feed.” In some cases limping may be the first symptom noticed. Fever with its attendant signs is present. If the mouth is examined there will be found blebs or bladders, technically called vesicles, varying in size from an eight-anna piece to a rupee or even larger, and containing a limpid yellowish-coloured fluid which later may become turbid. As the vesicles form the fever declines. They may appear simultaneously on the tongue, palate, cheeks, and mucous membrane of the trunk; if the trunk is seriously involved there is a sero-mucoid discharge. In young animals, as Gilchrist and Steel point out, the eruption may invade the mucous membrane of the bowels, giving rise to severe diarrhœa, exhaustion and death. In from eighteen to thirty-six

* “History and Treatment of Diseases of the Elephant,” by W. Gilchrist, 1841 and 1848.

† “Quarterly Journal of Veterinary Science in India,” Vol. I, 1882-83.

hours these blebs burst, leaving red, raw, angry-looking surfaces which may heal rapidly or become ulcerated. Owing to the soreness of the mouth and inability to eat, loss of condition may rapidly ensue. When the feet are attacked they become so tender that the slightest movement causes the animal to limp, and the pain may be so severe as to necessitate his lying down. On examination, the parts above the nails around the margin of the hoof-slipper will be found hot, swollen and tender. A discharge may be apparent; if not pressure on the parts may reveal some oozing. In the elephant, owing to the great weight to be sustained and the severe pain, fever may run high. The great danger is that the discharge may burrow, underrun the sole and thus lead to irritative fever, septicæmia (blood poisoning) in some form, and casting of the hoof-slipper.

Diagnosis.—This is distinguished from elephant-pox by the seat and nature of the eruption.

Treatment.—Careful nursing, feeding and attention to cleanliness are essential. When the mouth is very sore, allow plenty of good, well-boiled, freshly-made gruel; if the animal can take grass it should be cut, and care taken to see that it is clean and soft. A tub of fresh water should be kept near the standing. The mouth may be washed out three or four times daily with some mild astringent lotion, if very sore, *e.g.*, alum two drachms to the pint, or Condyl's fluid one ounce to a pint, or permanganate of potash two to four grains to the pint of water (*see* Formulæ 109, 110, 113, 117, 118, 119).

When the feet are involved great care must be taken to see that they are kept clean and dry and regularly washed with some antiseptic astringent lotion, such as carbolic lotion (1—60), corrosive sublimate (1—1,000), etc. (*see* Formulæ 110 to 113, 115).

The feet should then be dressed with any of the following:—Camphorated oil No. 122, carbolic oil No. 121, ointment of eucalyptus No. 128, or iodoform powder No. 64. Failing these, common tar and earth oil or kerosine oil in equal parts makes a good dressing. The feet should be covered with antiseptic or clean tow and bandaged, and over all a clean dry gunny bag should be tied or boots provided. Steel* notes that should a hoof-slipper be cast the case is not to be given up as hopeless. The horny investment of the foot is so simple that it can well be reproduced in the course of time.

With care and watchfulness the ulcers of the feet and trunk may be prevented from becoming the seat of maggots. The disease is not a fatal one as a rule, but if care be not taken neglected cases prove

* "A Manual of the Diseases of the Elephant."—J. H. Steel, 1885.

serious and tedious. The bowels should be kept regular with mild laxatives (*see* Formulæ 23 to 28).

During convalescence tonics should be given, such as—

Common salt	...	...	1½ oz.
Ginger	...	...	1 oz.
Chirreta	...	...	½ oz.
Aniseed	...	...	2 drs.

Twice daily.

Also 8 ounces of country spirit twice a day.

(For tonics *see* Formulæ 39 to 46.)

NOTE.—As this disease is more or less prevalent amongst the cattle in Burma the symptoms are given for ready reference. The disease attacks cattle, sheep, goats, pigs, etc., and man may contract it by drinking the milk of affected animals. The vernacular names for the disease are ဖျံ့နာသွါနာ (sha-na, kwa-na).

Symptoms.—Shivering fit, fever, smacking of the lips, discharge of ropy saliva, vesicular eruption in the mouth, tongue, palate, gums, cheeks, sometimes also on the udder and where the skin is thinnest; stamping of the feet, lameness; the eruption occurs in the form of vesicles around the coronet and between the claws. It sometimes happens that only the mouth is affected, at others only the feet, but usually both are involved. In sheep, goats and pigs the feet are more often affected than the mouth.

Differential diagnosis.—May in cattle be mistaken for rinderpest, but in foot-and-mouth disease there is an absence of dysenteric symptoms, which are invariably present in rinderpest. In foot-and-mouth disease the feet are nearly always attacked, but never so in rinderpest. Both diseases may co-exist in the same animal, although this is rare.

ELEPHANT-POX.

This is a specific fever characterised by eruptions somewhat similar to small-pox in man, but there is no evidence to prove that it is communicated from man or *vice versâ*. The eruptions begin as pimples, then become blebs or blisters, with clear fluid contents. Later the contents consist of matter. Finally they burst, leaving sores which tend to scab.

Prognosis.—Good, especially in adults.

Symptoms.—Fever with its attendant signs as mentioned under that condition and the eruptions above alluded to. I have seen only one case, namely, at Pakôkku. This animal came in from the direction of Gangaw. He was reported sick immediately on arrival. The mahout stated that the elephant had been out of sorts for some days, when suddenly this "heat" eruption appeared; also that the animal was weak and listless. The elephant was in good condition,

but his forehead, trunk, mouth, chest and shoulders, and a few places on the rump were covered with an eruption which had then arrived at the pustular stage.

Treatment: Preventive.—As laid down under anthrax, *i.e.*, segregation, etc.

Curative: General.—As laid down for fever.

Local.—Cleanliness, washing with weak disinfectants, such as carbolic acid, or phenyle (1—60) and afterwards dressing with carbolized oil (*see* Formula 121 and camphorated oil 122). All soiled dressings must be treated as in cases of anthrax, namely, be burned.

CHAPTER VIII.

RABIES. TETANUS. TUBERCULOSIS.

RABIES.

Rabies is a specific disease caused by the introduction into the system of a specific poison, through the bite of an animal, generally that of a dog, but jackals and wolves may also communicate it. It is a rare affection amongst elephants. The following case was communicated to Dr. Gilchrist by a mahout personally acquainted with the facts :—“ A mad dog, about five years ago, appeared in the elephant lines at Hyderabad. It attempted to bite several elephants, but was by each driven away. During the night it attacked an elephant when asleep and bit it on the trunk. The bite marks having been distinctly observed next day, a little oil was applied, but nothing more was done and nothing particular occurred till a month after the infliction of the bite, when decided symptoms of delirium, as described under the head ‘Ahren Bhao,’ suddenly supervened. During the first three days the animal took fodder, ratib and water, but afterwards took nothing. It did not appear to be afraid of water, as it drew it into its trunk and squirted it about, but did not drink any. It continued furious for two days, not allowing even the mahout to approach, after which it fell down and died suddenly. On the same occasion another elephant died fifteen days after the one above alluded to, with the same symptoms, but it was not clearly known whether the animal had been bitten by the dog, though it was one of those it attempted to bite. The above cases occurred about the month of October. A man and bullock had been bitten by the same dog, and both died mad.”

Quite recently a most interesting case came under the observation of Mr. H. F. Bowden, Bombay Burma Trading Corporation, to whom I am indebted for notes on the case.

On the 8th of June 1909, while a young trained calf was being bathed in a creek, a stray dog, said to be mad, was being chased by the villagers of Thabya-bin village. The dog ran towards the calf; on seeing the animal approaching she got up and, as the dog was passing, made a charge. The dog sprang at the elephant inflicting a severe bite under the left eye and made off. As the dog was reported to have bitten three villagers and some cattle, precautionary measures were taken, *i.e.*, the animal was removed to the

jungle, well fettered and watched. The wound was as soon as possible bathed with strong phenyle and water, regularly dressed and healed in the usual manner. Nothing unusual beyond that the attendant considered the animal had got a little thin was observed till the 4th July, on which date the animal became exceedingly restless, refusing to eat or drink anything. On the 5th she frequently screamed and gave utterance to most unusual noises, also lying down at intervals. The seat of the bite was noticed to be swollen. No one could approach, as she was more or less unmanageable. A watery discharge dripped continuously from the trunk.

On the 6th, the animal was very violent and made four desperate efforts to break away. She was continuously butting and kicking at imaginary objects, which from her circular motion were apparently following her from behind. Her condition was such that Mr. Bowden intended to shoot the animal. During the afternoon, however, her strength seemed to be flagging, and on approaching cautiously the mouth and tongue were noticed to be bluish in colour and a large quantity of sticky saliva was being discharged from the mouth. The end of the trunk was noticed to be raw.

On the 7th, the animal appeared to regain strength, but about 10 A.M. she went down, and started grovelling on the ground and (as narrated) snapping at the air. She rapidly became exhausted and died at 1 P.M.

An account of a case is also contributed to the "Oriental Sporting Magazine" by Captain F. H. Hood, B.S.C., Volume III.

Treatment.—Should an elephant chance to be bitten by a dog, the wound should be thoroughly cauterized without delay with pure carbolic acid and dressed with carbolic lotion 1 in 40, or a very strong solution of lunar caustic, or the wound may be cauterized with a hot iron. Liquid caustics are preferable to solid. (Also see Formulæ 57 to 60.) Soiled dressings should be burned.

The elephant should be removed to a distance from habitations, well secured, and kept under constant observation.

The early symptoms are excessive restlessness, trembling, convulsive twitchings; a desire to break away; later on, inability to swallow. On the manifestation of any extraordinary behaviour, extra shackles should be applied and the animal destroyed without delay.

TETANUS OR LOCK-JAW.

Definition.—An infective disease due to the entrance into the blood of a poison generated by a germ, the tetanus bacillus. This disease is rare in these creatures.

Incubation.—Varies from a few hours to several days.

Prognosis.—Unfavourable ; usually fatal.

Causes.—Absorption of the germ through an abraded surface, wounds, sores and particularly punctured wounds about the feet. This germ remains local and does not enter the blood.

Symptoms.—Dulness, stiffness of the muscles about the jaws, stiffness in movement, sunken eyeballs, timidity, hypersensitiveness to sounds, with repeated attacks of violent spasms of the muscles of the body and often irregular fever. The most characteristic symptom after spasms is the partial or complete locked condition of the jaw.

Gilchrist states there is full power of moving the trunk, but the movements of the ears are not so free as in health.

Treatment : Preventive : Segregation.—Though it is a less contagious disease, infection has been known to attach itself to certain stables for years.

Curative : (a) Local.—Careful inspection for abrasions, sores, and if found careful cleansing with carbolic lotion (1 to 40), cauterization with pure carbolic acid and careful dressing. Search should be made for thorns, splinters, and if found removed, and wounds treated as above.

(b) General.—Isolate, preferably in a quiet dark shady place. Quietude as perfect as can be arranged for is one of the most essential points in furthering a favourable issue. Clean water, freshly-made gruel and some tempting fresh fodder should be placed within easy reach. When possible a brisk purgative should be given by the mouth ; if not possible by this means, remove the dung from the rectum and give an enema, a pint and half of castor-oil (Formulæ 77 to 80). Powdered henbane leaves or seeds in 2-dr. doses may prove beneficial. Take of extract of belladonna 4 drachms and glycerine 1 ounce, water 2 drachms and rub the mixture into the muscles of jaws. Unnecessary interference in these cases is to be deprecated.

All dressings when removed must be placed in a proper receptacle (never on the ground or floor) and subsequently burned under supervision, and the receptacle cleansed with carbolic solution (1 in 40).

TUBERCULOSIS.

Tubercular disease is so far as I am aware extremely rare in the elephant probably owing to his mode of life. However, that it may occur is proved by an interesting case which was reported by

Dammann and Stedefer* of one of two elephants which were sent to the surgical clinique of the Hanover Veterinary School in July 1908 for the treatment of wounds about the feet. It is stated that the larger of these two elephants died in August 1908 as a result of blood poison (septicæmia) arising possibly from the wounds. The *post-mortem* examination revealed tuberculosis of the lungs and of the bodies of several vertabræ.

The result of the bacteriological examination, according to Dammann and Stedefer, seemed to show that the disease was of human origin, which is not surprising, seeing how fond people are of feeding animals in captivity. It does not require much demonstration to show that the consumption of food offered by tuberculous persons may lead to the animal being infected. From the report quoted it does not appear that the elephant in question showed any symptom of tubercular disease during life. In any case the disease is not likely to be diagnosed in the jungle.

* Dammann and Stedefer, Deuts. Tierarztl. Wochens, June 12th, 1909, page 345.

CHAPTER IX.

EPIDEMIC PNEUMONIA. EPIDEMIC DYSENTERY. RINDERPEST IN CATTLE.

EPIDEMIC PNEUMONIA.

This is based on the description of an epidemic in 1839 on the coast of Tenasserim and recorded by Dr. MacDonald.

Many elephants were attacked simultaneously, and at that time bullocks were suffering from apparently the same disease. The mortality was very high; no symptoms are recorded, but on *post-mortem* usually one lung was found extensively diseased, the other "pretty healthy," which leads one to infer that it was *not* quite healthy. The diseased portions of lung were engorged, and in colour varied from florid red to black. Referring to the works I have had access to, it is significant that no other author has seen a similar outbreak. The *post-mortem* appearances recorded are more or less compatible with cases of pulmonary anthrax.

EPIDEMIC DYSENTERY OR MURRAIN.

Such a condition has been described, which does not differ in symptoms or treatment from the above, but as it attacks several animals simultaneously it may be regarded as infectious, and beasts so affected must be isolated with the same precautions as laid down under "Anthrax." The mortality mentioned is 80 per cent. I have never seen this condition in elephants, but have met with a similar condition among buffaloes in this province at the end of the hot season, when after the first few showers the young grass crops up rapidly. It may be due to the entrance of a micro-organism. The disease was as fatal as severe cattle-plague.

RINDERPEST—CATTLE PLAGUE.

The following is an extract from the report of the Imperial Bacteriologist to the Government of India for the year 1906-07 :—

"Insusceptibility of the Indian Elephant to Rinderpest."

"In order to determine whether elephants are susceptible to

rinderpest and suffer from the disease during outbreaks amongst cattle and other animals, a female elephant, in perfect health and condition, normal temperature ranging between 36° and 37.3° C., was subcutaneously inoculated with 500 c.c. of virulent defibrinated blood obtained from a hill bull, the subject of well-marked rinderpest. A diffused swelling occurred at the seat of inoculation, which has decreased in extent after a period of twenty-four hours and only a slight thickening of the skin was perceptible a few days later. No rise in temperature was recorded, and the animal never exhibited any untoward symptom of any kind during the following twenty-three days."

This experiment on one animal only can hardly be regarded as conclusive evidence that the elephant does not contract rinderpest, as this particular animal may have been naturally insusceptible or have been immunized by a previous attack. There is reason to believe, however, that elephants are insusceptible. I have never heard of nor seen a case, and in Burma it would have been impossible for some of the vast number of elephants so frequently exposed to contagion to escape contracting rinderpest. Nevertheless, it may not be time wasted to give a summary of the symptoms of this disease, as foresters generally employ a considerable number of buffaloes in addition to elephants, and when they get rinderpest among the former—being unacquainted with the signs and considering it to be some fatal malady likely to affect their elephants also—very often throw them out of work and remove them to a safe distance. In order that they may be able to recognize the disease and thus save anxiety and expense of keeping their elephants idle, the following facts with regard to it may be noted :—

NOTE.—

Vernacular names for disease in cattle.

ကွတ်နာ။ (Kut-na). ကော့နာ။ (Ka-ba-na).

မိုးကျနာ။ (Mo-kyā-na). ကာလာနာ။ (Ka-la-na).

ထွေးထွန်ဝင်းကျနာ။ (Thwe-thun-wun-kyā-na).

Incubation.—Three to seven days after exposure to contagion.

Duration.—Three to eight or nine days usually, but cases may run on to fifteen days or so.

Symptoms.—Generally divided into three stages. It should be remembered all the symptoms enumerated are not invariably present, but if carefully looked for many will be observed.

First stage.—Considerable rise in bodily temperature, pulse and respiration accelerated, dulness, drooping ears, rough coat, back arched and feet drawn together, shivering and twitching of groups of muscles, tenderness over the spine. The animal is more or less off food, there is no marked thirst, and chewing the cud is slow and irregular. The mucous membrane of mouth is congested, the bowels constipated, urine high-coloured.

Second stage.—Fever runs high, the pulse fast and irregular, respiration increased, the surface temperature varies, the tenderness over spine is more marked, as also the muscular twitchings, and movement is difficult; the animal may lie down. Thirst is intense, the appetite lost. A slight discharge from the eyes may be observed, the mucous membrane of mouth and along gums is very red and the tongue furred. The bowels are constipated, any dung passed is hard, covered with blood and mucus, and the act is accompanied by much straining.

Third stage.—The animal is as a rule much prostrated and lies down. There is considerable discharge from the eyes, nostrils and mouth, the skin and extremities are cold, the animal moans and grunts. There is often a cough and difficulty in breathing, the breath is offensive and the mucous membrane of the mouth will be found excoriated and covered with a yellowish deposit, especially the corners of the mouth, along the gums, roof of mouth and, in very severe cases, even inside the nostrils and eyelids. The constipation is now succeeded by diarrhoea, at first the evacuations are covered with mucus and blood, later they become watery and finally they consist of liquid with a mixture of blood, and flakes of mucus. Towards the end the fæces—a liquid bloody discharge—are passed involuntarily. The pulse becomes imperceptible and the temperature drops considerably. Cows in calf generally abort.

It is probable that the attention of Foresters will be drawn to cases somewhat advanced, so it will be well to remember the predominant symptoms: dejected state of animal, marked prostration, discharge from eyes, nostrils and mouth, offensive breath, soreness of the mouth, violent dysentery which is most offensive.

Post-mortem appearances.—In acute and rapidly fatal cases the mucous membrane of the mouth and throat will be found swollen and congested, the mucous membrane of the fourth stomach particularly so. In the bowels patches of congestion will be noticed, and the membrane covered with a nasty blood-stained secretion.

In less rapid cases more characteristic lesions are met with, the chief of which are seen in the fourth stomach and bowels. In the former the mucous membrane will be found deeply congested, often of a claret colour, with streaky patches of hæmorrhage. Ulcers round about pyloric orifice and on the folds are often observed, also a sort of false membrane formed by the inflammatory exudate. This can readily be removed. For some distance the condition of the first portion of the small bowel is in a state similar to that of the fourth stomach. In the remaining portion patches of congestion will be met with, also the inflammatory exudate. The large intestines are more or less congested and hæmorrhages are met with. In the rectum the congestion is a bright red, and in longitudinal streaks as a rule. In some cases it is almost black.

The lungs are generally congested; the liver is often soft and sometimes congested; the gall bladder generally full, and the mucous membrane ulcerated with patches of yellowish deposit.

APPENDICES.

APPENDIX A.—LAW CASES.

IN Burma tame animals are constantly escaping and joining wild herds. It is therefore well to know the law on the subject, as the question of ownership of such animals has often been raised in India. The following case is quoted from Sanderson :

“ The following is a case on appeal decided in the High Court of Judicature, Calcutta, in favour of the Government establishment that recaptured an escaped elephant :—

“ Plaintiff, a zemindar, alleged that he had the female elephant in question in possession for six years, when she fled to the jungles. He made diligent search for her, and reported her loss at the nearest district police-station. He heard a year later that she had been recaptured in the Sylhet district in the Government Kheddahs. His claim to the animal being rejected by the Superintendent of Kheddahs, he instituted a suit for her recovery in the Court of the Collector of Sylhet. The Collector gave judgment in favour of the Superintendent of Kheddahs on behalf of Government. Plaintiff thereupon appealed to the High Court of Judicature, Calcutta, but his appeal was dismissed on the grounds that such animals being originally *feræ naturæ* are no longer the property of man than while they continue in his keeping. If at any time they regain their natural liberty, his property ceases, unless they have *animus revertendi* which is only to be known by their usual custom of returning or, unless instantly pursued by their owner, for during such pursuit his property remains. In this case pursuit had ceased, and the animal had returned to its natural and independent state.”

CIVIL SECOND APPEAL NO. 25 OF 1900, MAY 7TH, 1900.

Before the Judicial Commissioner, Upper Burma.

MAUNG KYAW DUN *Applicant*

v.

(1) MA KYIN } *Respondents.*
(2) NARAYANAN CHETTY }

Injury caused by animal, tame or wild—Injury due to owner's negligence—
Liability for—Proof of negligence—Proof of *scienter*—Necessity for.

A man should be liable for injury caused by his animal, whether tame or wild, if it is proved that the injury was due to the owner's negligence.

Maung Gyi v. Po To (1) approved.

In that view it would not be necessary to draw a distinction between wild and domestic animals. The point for decision would be whether the owner was guilty of negligence or whether he used such care as in the circumstances of the case was reasonable and ordinarily sufficient. The amount of care required would vary according to the class of the animal and according to its own disposition. It would not be laid down in this country that a man is liable for any damage done by his elephant without any proof of negligence or that he knew it to be of a vicious disposition. In view of the manner in, and extent to, which elephants are employed in this country, such a proposition would be manifestly unjust. —*Filburn v. People's Palace Company* (2) distinguished.

In the present case it was for the plaintiff to prove that the damage done to his elephant was caused or rendered possible by the defendant's negligence. In considering the question of negligence, the defendant's knowledge or want of knowledge that her elephant was of a vicious disposition would be an important point. In a suit of this kind, where an animal like an elephant is concerned, the burden of proving negligence is in the first place on the plaintiff who avers it. It might be otherwise if the injury by a tiger or a bear were concerned.

White, J.—The plaintiff-appellant sued to recover damages on account of the death of his elephant, "Do," which died from the effect of wounds inflicted by the respondent's elephant, "Kya Gyi."

The issues which arise in a case of this kind have been stated in two cases of this Court. In *Maung Gyi v. Po To* (1) it was observed that the issue generally would no doubt be the usual issue as to the existence of negligence on the part of the owner of the animal doing the damage. In *Maung Swa v. Maung Kyaw* (3) points which arise in a case very similar to the present were indicated. There has been some argument in this Court on the application of the doctrine of *scienter*. It is said that "any one who keeps a wild animal, as a tiger or bear, which escapes and does damage, is liable without any proof of notice of the animal's ferocity; but where the damage is done by a domestic animal, the plaintiff must show that the defendant knew the animal was accustomed to do mischief (4)." Again, "a person keeping a mischievous animal with knowledge of its propensities is bound to keep it secure at his peril.

If it escapes and does mischief, he is liable without proof of negligence, neither is proof required that he knew the animal to be mischievous, or if it is a notoriously fierce or mischievous species (5).” In Smith’s leading cases, in the notes on *Fletcher v. Rylands* (6) it is said :—

“The law of England recognizes two distinct classes of animals: The first class consists of such animals as sheep, horses, oxen, and dogs, which the law assumes not to be of a dangerous nature, and a person who keeps an animal of this class is not liable for any damage it may do, when not trespassing, unless he knew that it was in fact dangerous. The other class consists of animals which have not been shown by experience to be harmless by nature; and one who keeps animals of this class must prevent them from doing injury under any circumstances, unless the person to whom it is done brings it on himself.”

In the English case on which these remarks are based, namely, *Filburn v. People’s Palace Company* (2), it was held that an elephant “did not belong to a class which, according to the experience of mankind, is not dangerous to man, and therefore the owner kept such an animal at his own risk, and his liability for damage done by it was not affected by his ignorance of its dangerous character.”

I understand the remarks of my learned predecessor in *Maung Gyi v. Po To* (1) above cited to go no further than to suggest that a man should be liable for injury caused by his animal, whether tame or wild, if it is proved that the injury was due to the owner’s negligence. In that view, it would not be necessary to draw a distinction between wild and domestic animals. The point for decision would be whether the owner was guilty of negligence or whether he used such care as in the circumstances of the case was reasonable and ordinarily sufficient. The amount of care required would vary according to the class of the animal and according to its known disposition. It could not, I think, be laid down in this country that a man is liable for any damage done by his elephant without any proof of negligence, or that he knew it to be of a vicious disposition. In view of the manner in, and extent to, which elephants are employed in this country, such a proposition would be manifestly unjust.

In the present case, therefore, I think it was for the plaintiff to prove that the damage done to his elephant was caused, or rendered possible, by the defendant’s negligence. In considering the question of negligence, the defendant’s knowledge or want of knowledge that the elephant was of a vicious disposition would be an important point. In a suit of this kind, where an animal like an elephant is concerned, I think the burden of proving negligence is

in the first place on the plaintiff who avers it. It might be otherwise if injury by a tiger or bear were concerned.

I agree with the Lower Courts in thinking that it is not proved that the defendant knew that the elephant "Kya Gyi" was of a vicious disposition. It was not therefore incumbent on her to take more than ordinary precautions with him. It does not seem to be shown that ordinary precautions were neglected. It is alleged that "Kya Gyi" twice gored the deceased elephant "Do," and the mahout called by the plaintiff declares that he had neither bell nor fetters. On the other hand, as pointed out in the judgment of the Court of First Instance, the plaintiff himself admitted that "Kya Gyi" had a bell and fetter on the second occasion. It is admitted that all the other elephants of the defendant had bells and fetters; there is direct evidence, at least as good as that for the plaintiff, that "Kya Gyi" was properly provided with them. In my opinion it has not been proved that there was any negligence on the part of the defendant and any *primâ facie* case made out by the plaintiff has been rebutted. I therefore hold that the Lower Courts have rightly decided that the defendants are not liable; and I dismiss this appeal with costs. (*See* Part I, page 51.)

APPENDIX B.—OPERATIONS.

In performing an operation such as opening an abscess on the back or treating a sore back in a troublesome elephant, it is a common practice, to obviate the necessity for securing him, to take the animal into deep water where he is obliged to swim. Once off his legs he is kept busy swimming and cannot hurt anyone on his back. Taking an animal up to his girth in mud, slush or swamp answers equally well. It is desirable to have neck, girth and side ropes in order to retain one's seat in case the animal should try to shake the rider off before or on entering the water. (*See* Part I, page 54.)

APPENDIX C.—AGE.

To form an approximate estimate of the age of an elephant constant association and practice are requisite.

As already stated there cannot be much doubt about the age of young animals, the general appearance, muscular development, smooth well-formed nails, height, size of ivory, if any, state of the ears that is straight edged and freedom from tears, etc.

With regard to the amount of turnover of the ear as an indication of age it must be remembered that exceptions occur; occasionally one may meet with an elephant of five or six years with a turnover of an inch, but no one would be likely to take such a beast to be thirty or even ten years.

Again, a youngster may be seen with the edge of one ear turned while the other is perfectly straight. In judging the approximate age all such like exceptions must be taken into account. (*See Part I, page 4.*)

APPENDIX D.—GROWTH INCREMENT.

Growth Increment in Sixteen Elephants during two years.

Number.	MARCH 1907.		MARCH 1909.	Increase for two years.
	Estimated age.	Height.	Height.	
1	11	6' 7 $\frac{1}{2}$ "	7' $\frac{1}{2}$ "	5 "
2	12	6' 4 "	6' 6 "	2 "
3	15	6' 10 "	7' 0 "	2 "
4	16	7' $\frac{1}{2}$ "	7' 1 $\frac{1}{2}$ "	1 "
5	18	7' 2 $\frac{1}{2}$ "	7' 2 $\frac{1}{2}$ "	0 "
6	18	7' 2 $\frac{1}{2}$ "	7' 4 $\frac{1}{2}$ "	2 "
7	18 to 20	7' 1 "	7' 1 "	0 "
8	20	7' 7 "	7' 7 $\frac{1}{2}$ "	$\frac{1}{2}$ "
9	20	7' 7 "	7' 7 $\frac{1}{2}$ "	$\frac{1}{2}$ "
10	25	7' 4 $\frac{1}{2}$ "	7' 4 $\frac{1}{2}$ "	0 "
11	25	7' 5 "	7' 5 $\frac{1}{2}$ "	$\frac{1}{2}$ "
12	27	7' 3 "	7' 3 $\frac{1}{2}$ "	$\frac{1}{2}$ "
13	27	7' 1 $\frac{3}{4}$ "	7' 2 "	$\frac{1}{4}$ "
14	30	8' 1 $\frac{1}{2}$ "	8' 2 "	$\frac{1}{2}$ "
15	30	7' 7 "	7' 7 $\frac{1}{2}$ "	$\frac{1}{2}$ "
16	35	7' 6 $\frac{1}{2}$ "	7' 7 $\frac{1}{2}$ "	1 "

(*See Part I, page 5.*)

APPENDIX E.—LIST OF FODDER PLANTS, GRASSES, ETC.

List of some Trees, Creepers, Grasses, etc., eaten by Elephants.

Burmese Name.	Vernacular.	Scientific.	Remarks.
Paung	ပေါင်းကိုင်းပင်	Saccharum procerum?	Eaten readily but not very nourishing
Kaing	အဆင်ကိုင်းပင်	Saccharum spontaneum?	One of the most valuable of fodders
Kyan-sa-nwai	ကျံစွယ်ကိုင်းပင်	Toddalia aculeata	Considered to be one of the best fodders and very fattening
Naya	နားထားမျှစာပင်	.....	Fattening and eaten readily
Taw-hngyet-pyaw (Wild plantain)	ထောင့်ရှင်ပျော	Musa rubra and varieties	Fattening and supposed to be sought after as a thirst quencher
Padaw	ပထောင့်မြက်	.....	A useful grass, considered very nourishing
Ohniet	ဒိုးလက်	Cocos nucifera	Strengthening and fattening
Pyang-yo (Millet)	ပြောင်းရိုး	Andropogon sorghum	A very excellent fodder
Minbaw	မင်းတောင်	Caryota urens	Considered fattening. Leaves eaten and stem split to obtain the pith which they are very fond of
Wetla	ဝက်လာ	Cyperus compressus and varieties	An inferior fodder: eaten but not nourishing
Kyan (Sugarcane)	ကြံ	Saccharum officinarum	Very fattening
Kyu-nabin-pake, Kyu	ကျူနပ်ပိတ်	Arundo sp.	Fattening and readily eaten
Sin-dôn-ma-nwai	ဆင်တုံးမနွယ်	Tinospora nudiflora	Much sought after. Bitter in taste and considered to have an excellent tonic effect, especially in debility
Ta-ma-zaing	တမနိုင်း	Panicum acariferum	A nourishing grass eaten freely
Myin-wa	မြိုင်ဝါး	Dendrocalamus strictus	} Are considered the best
Wa-pyu	ဝါးဖြူ	Dendrocalamus membranaceus	
Wa-bo	ဝါးဝိုင်း	Dendrocalamus Brandisii	
Kya-lo-wa	ကျူလိုဝါး	Bambusa Brandisii	
Kyakat-wa	ကျူခတ်ဝါး	Bambusa arundinaria	} Are thought by Burmans to cause slight congestion of the kidneys
Kya-thaung	ကျူသောင်း	Bambusa polymorpha	
Thaik-wa	ထိုက်ဝါး	Bambusa tulda, Bambusa offinis	
Tin-wa	တင်းဝါး	Cephalostachyum gracile	
Salu	.....	Licuala peltata	Much liked
Yingan	.....	Zalacca Wallichiana	Fruit much sought after

List of Trees, Creepers, etc., on which Elephants browse and which are supposed by Burmans to possess sundry medicinal properties.

Burmese Name.	Vernacular.	Scientific.	Remarks.
Nyaung (Banyan) ...	ညောင် ...	Ficus indica ...	} Most of the species of "ficus" are eaten by elephants and are considered to have a constipating effect
Tha-pan or	ထပ်ပန်း ...	Ficus glomerata ...	
Ye-tha-pan ...	ရေထပ်ပန်း ...	Ficus lanceolata ...	
Sin-tha-pan ...	ဆင်ထပ်ပန်း ...	Ficus Roxburghii ...	Leaves readily eaten. Considered constipating
Okhne ...	အိုးနှံပင် ...	Streblus aspera ...	Said to be useful in flatulence
Than-that ...	ထီထတ် ...	Albizzia lucida ...	} Considered to be active diuretics
Ka-aung-gyi ...	ခအောင်ကြီး ...	Clerodendron infortunatum ...	
Pauk-nwai ...	ပေါက်နွယ် ...	Butea parviflora Spatholobus Roxburghii ...	
Kyu-bin ...	ကျူပင် ...	Terminalia citrina ...	} Eagerly sought after by elephants, but it is stated that if the sap gets into an elephant's eyes it causes opacity
Pai-kwai ...	ပဲခွေနွယ် ...	.....	
Doh-nwai ...	ဒိုးနွယ် ...	.....	
Sha-bauk-nwai ...	ရှပေါက်နွယ် ...	Butea superba ...	} Stated to cause congestion of the liver
Su-bók ...	ဆူးပုင်ပင် ...	Acacia concinna rugata	

(See Part I, page 20.)

APPENDIX F.—BREEDING.

Mr. Dalglish of the Borneo Company, Chieng-Mai, kindly sent me some interesting notes on this subject :—

(a) A male transport elephant, Pu-Tat, tried to mount Me-Oong while on the march, but was prevented from doing so. After the load was removed from Me-Oong however, he promptly crossed her, the congress lasting some two minutes. On moving away from her another bull, Pu-Ek, tried to jump her but failed. He thereupon chased Pu-Tat but fell down before reaching him. He got up, returned to Me-Oong and crossed her successfully, the congress lasting some three minutes. The female remained perfectly quiet the whole time and made no attempt to move away from either of the bulls; she did not appear to be on heat nor did she utter any sound, and as far as could be seen did not court their attentions in any way. Pu-Ek was *musth* at the time, but Pu-Tat

was not. This all occurred in an open paddy field and only a few yards from where Mr. Dalglish was standing. He has now witnessed this act on five occasions and not on any one did the congress last more than three minutes. In all cases the animals except for a slight movement of the tail remained motionless.

(b) No. 218, Ne-Nooan, belonging to the Borneo Company, Limited, dropped a still-born calf (sex not reported) in December 1907; the same elephant dropped a male calf in October 1909; that is well within two years. This case proves that cow elephants will permit of intercourse with a bull shortly after calving. The explanation in this instance may be that the first calf was still-born. (See Part II, pages 93—95.)

APPENDIX G.—CASE OF IMPACTION AND RUPTURE OF ŒSOPHAGUS.

Mr. Hepburn in a letter describes a case of impaction and rupture of the gullet which he recently met with in an elephant.

The animal in question was gored by a wild tusker in the middle third of the neck. The wound was deep and extended inwards and upwards. It was enlarged and washed out twice daily and it gradually healed. The animal was not put to work. A short time afterwards he was reported not to have touched food for two days. Mr. Hepburn saw him late in the evening. He found the animal not exactly vomiting, but his mouth was kept open and large quantities of a clear watery fluid were discharged. He had not partaken of any food and the breath was noticed to have a very offensive smell. He died the next day.

On *post-mortem* the original wound was found closed but a channel was met with running downwards along the gullet and windpipe into a cavity full of pus and food. A rupture about one inch long was found on the upper surface of the gullet which was impacted with food for some distance above.

Mr. Hepburn is of opinion that the impaction and rupture resulted from the pressure of the abscess on the gullet. (See Part IV, page 252.)

APPENDIX H.—SURRA.

Mr. Hepburn kindly gave me a few notes on an outbreak of *surra* which occurred amongst some of the elephants in his charge. The principal symptoms noted by him were dulness, a heavy sleepy look about the eyes, paleness of mucous membranes and considerable fever, together with œdematous swellings in various parts of the body. In one case there was a slight mucoid discharge from the eyes. There was not much loss of condition. The treatment

adopted was the administration of arsenic in gradually increasing doses until symptoms of poisoning set in; out of five animals attacked three recovered and two died. Mr. Hepburn had no opportunity of making a *post-mortem* examination.

With regard to the above method of treatment I may remark that I have doubts about the ordinary preparations of arsenic in the doses given effecting a cure within a reasonable time. My grounds for this statement are that I have had several elephants under arsenical treatment for many months. Blood smears were taken daily from the affected animals and examined. It was observed that the period of time which elapsed from the disappearance of the parasites from the peripheral circulation and their reappearance therein extended in more than one case to over three months. Unless therefore careful daily examinations of the blood are made for a lengthened period after apparent cure wrong conclusions may be arrived at. In cases which are observed early, *i.e.*, when the animals appear healthy and in good condition, provided they are rested or at most put only to light work the exhibition of arsenic undoubtedly keeps them in a more or less stationary condition as regards general appearance and bodily health. (*See Part V, page 310.*)

APPENDIX I.—NOTE ON INFECTIVE DISEASES WITH SPECIAL REFERENCE TO ANTHRAX.

Note I.—In order to enable the non-professional reader to realise how infectious disease is spread I have thought it advisable to add a short summary of the causes of infective diseases.

Infective diseases are caused by minute organisms known popularly as *microbes*. A *microbe* is a unicellular vegetable organism belonging to the class schizomycetes or fission fungi. Under the microscope these organisms are seen to adopt certain definite forms and appear as small spherical bodies, short thick rods or long thin filaments. In size they are exceedingly minute, many being not more than $\frac{1}{25000}$ of an inch in length. Some like the anthrax organism are only capable of existing and growing in the presence of oxygen; others die if exposed to the air. These organisms multiply by simple fission, that is to say the organism if placed in favourable surroundings so far as nutrition and growth are concerned simply divides into two. Thus in a very short time a single organism may produce a horde. Outside the animal body some microbes produce what are known as *spores*. A *spore* is not a multiplication form but simply a resting stage of the organism adopted when its surroundings are unfavourable to its growth and nutrition. When these spores gain entrance to the animal body they again take on the form of the

original organism. It must be remembered that the spore is infinitely more resistant than is the parent organism so that ordinary methods of disinfection are not sufficient to destroy its vitality.

In the case of the anthrax organism for instance, so highly resistant is the spore that it may remain quiescent for years in unfavourable circumstances, and it only develops into a bacillus on gaining entrance to the animal body either through a wound, by being ingested along with the food or water, or by being inhaled with particles of dust, etc. Even boiling water does not immediately destroy the anthrax spore. The anthrax bacillus only forms a spore outside the animal body and then only in the presence of oxygen and provided the temperature is between 70°F . and 107°F . So long as the carcase remains intact no spore formation can take place because the bacilli being deprived of oxygen soon die. Hence the great importance of not cutting into the carcase of an animal suspected to have died of anthrax, and of carefully disinfecting the bloody discharges which generally exude in such a case from the natural orifices. After disinfection these orifices should be plugged with some material such as tow or rags previously soaked in carbolic acid or a similar disinfectant.

Note II—Anti-anthrax serum.—Various investigators at different times have manufactured sera with protective and curative properties against anthrax. Perhaps the best known of these is "Slavo's serum." It is made by injecting increasingly large doses of virulent anthrax material under the skins of animals previously immunised against the disease. The serum in the blood of animals so treated, in time acquires properties exceedingly inimicable to the anthrax bacillus. Adequate doses of such a serum injected under the skin of an animal should serve to protect against anthrax for about a fortnight.

If this serum and a small dose of virulent material be injected simultaneously an immunity lasting for perhaps a year may be acquired, but there is some risk of the animal acquiring virulent anthrax during the process and dying. The method in cattle has been used on a large scale in South America, I believe with great success.

An anti-anthrax serum has been made at the Imperial Bacteriological Laboratory, Muktesar, India. It has been used in controlling outbreaks in cattle and horses but the simultaneous method has never yet been tried in India.

Another well-known serum, which has been largely used in combatting anthrax is that known as "Sobernheim's"; it differs in no essentials from the above sera.

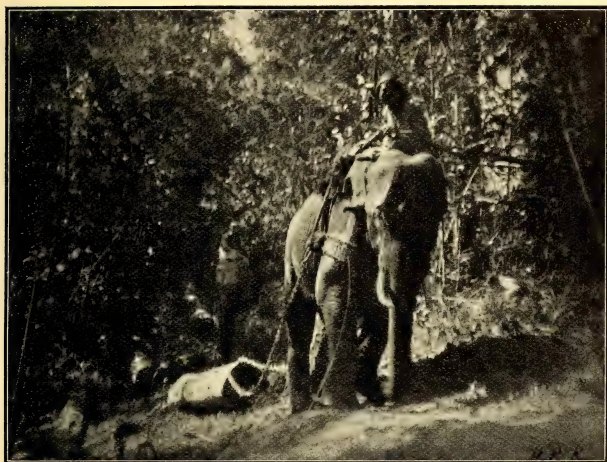
Anti-anthrax serum in large doses has been proved useful as a curative in human practice. In domestic animals the period between the onset of symptoms and the animal's death is usually too short to admit of this being attempted.

PLATE XVI (I).



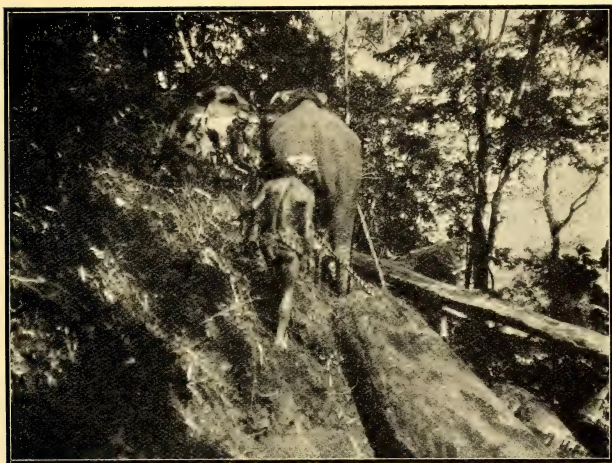
ELEPHANTS AT WORK.

PLATE XVI (2).



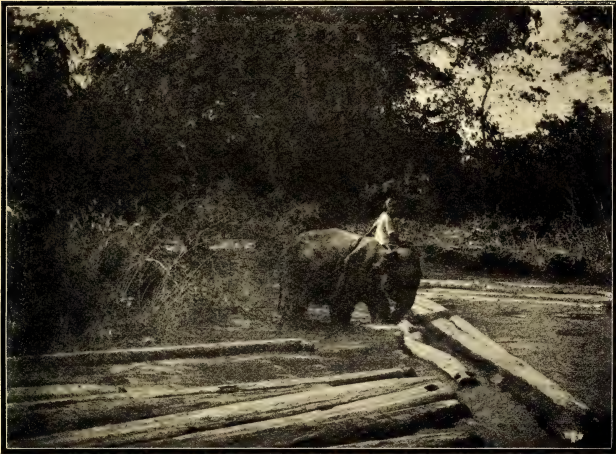
ELEPHANTS AT WORK.

PLATE XVI (3).



ELEPHANTS AT WORK.

PLATE XVI (4).



ELEPHANTS AT WORK.

INDEX.

	PAGE		PAGE
"AAK KA JUR"	145	Anthrax, causes, symptoms and treat- ment	288
"Aak ka phul"	145	— in other animals	301
"Aam ka bitchee"	153	— <i>post-mortem</i> examination in	295
"Aam ka zad ka chal"	153	— vaccination for	298
Abdominal cavity, anatomy of	83	Anti-dysenterica, actions, uses and doses of	143
Abrasions, causes and treatment	202	Antimony, actions, uses and doses of	143
Abrus precatorius	140	Aperients, definition and examples of	120
Abscess, causes, symptoms and treat- ment	186	Aphthæ epizooticæ, causes, symptoms and treatment	313
— method of opening	187	Areca-nut, actions, uses and doses of	143
— serous	188	Argenti nitras, actions, uses and doses of	143
Acacia gummi, actions, uses and doses of	140	Arrack	143
Acetum, actions, uses and doses of	140	Arsenicalis liq., actions, uses and doses of	143
Acid, boracic, actions, uses and doses of	140	Arteries, description of	81
— carbolie, actions, uses and doses of	140	Articulations, definition of	62
— gallic, actions, uses and doses of	141	— examples of	63
— nitric, actions, uses and doses of	141	Assafetida, actions, uses and doses of	143
— tannic, actions, uses and doses of	141	Astringents, definition and examples of	118
Aconite leaves, actions, uses and doses of	141	"Atis"	141
— tincture, actions, uses and doses of	141	Attendants, duties of	34
Adeps preparata, actions, uses and doses of	141	— native names for	34
Aether, actions, uses and doses of	141	— number of	34
— nitrous, actions, uses and doses of	141	"BABUL"	140
"Afeem"	155	"Bach"	159
"Afeem ka arak"	155	Backbone, anatomy of	68
Age	2	Bael fruit, actions, uses and doses of	143
— action of aged animals	4	"Baibarung"	143
— appearance of aged animals	3	Bamboo leaves, actions, uses and doses of	143
— Burmese names indicating	3	"Banss ka putta"	143
— indications of	3	Barbalion, actions, uses and doses of	144
— judging the	3	"Barik tel"	151
— turn-over of ear as indicating	4	Bathing, necessity for	33
"Ajmayan"	160	— times of	33
Albumen, egg, actions, uses and doses of	141	Bdellium, actions, uses and doses of	144
Alimentary tract, description of	83	"Belgan dan"	157
Allspice, actions, uses and doses of	141	Belladonna extract, actions, uses and doses of	144
"Alsi ka tel"	152	"Belly-ache"	248
"Alsi-tisi"	152	Benzoin, actions, uses and doses of	144
Alum, actions, uses and doses of	142	Betelnut, actions, uses and doses of	144
"Amaltas"	146	Bhang, actions, uses and doses of	150
"Amhli"	159	Bhela, actions, uses and doses of	144
Ammonia chloride, actions, uses and doses of	142	"Bilayeti nimuck"	149
Amphistomes	271	Bile, nature and uses of	105
Amylum, actions, uses and doses of	142	"Bil patri"	143
"Anar darum"	157	"Bish"	141
Aniseed, actions, uses and doses of	142	Bismuth, subnitrate, actions, uses and doses of	144
Anodynes, definition and examples of	117		

	PAGE		PAGE
Bistoury	114	Carbohydrates, action of digestive	
Bladder, description of	88	juices on	105
— inflammation of	234	— physiological consideration of	104
Bladder-worm	276	Carbo ligni, actions, uses and doses of	145
Bleeding, arrest of	180	Cardamons, actions, uses and doses of	145
Blisters, definition and examples of	124	Caries of the teeth	174
— method of applying	124	Carminatives, definition and examples	
— uses of	124	of	118
Blood, composition of	101	Carron oil, action and uses of	146
— cells	102	Cassia bark, leaves and pulp, actions,	
— smears, method of preparing	283	uses and doses of	146
— worms in the	230	Castor oil, actions, uses and doses of	146
Blood-letting, objects of	171	Castration of elephants	90
— method of	172	Cataract, causes, symptoms and treat-	
Blood-poisoning	285	ment	265
Boils, causes, symptoms and treat-		Catarrh, symptoms and treatment	225
ment	207	Catechu, actions, uses and doses of	146
“Bol”	154	Cattle plague	321
Bolting, prevention of	55	Caustics, definition and examples of	125
Bonduc, actions, uses and doses of	144	Cells, definition of	100
Bone, classes of	61	Chains for dragging	40
— composition of	61	— tethering	50
Borax, actions, uses and doses of	144	Chalk, prepared, actions, uses and	
Bots	268	doses of	146
Bowels, inflammation of	250	“Charayata”	146
— intussusception of	246	Chest, anatomy of	76
— stoppage of	246	— existence of pleural cavity in	76
Brain, anatomy of	64	Chirretta, actions, uses and doses of	146
— apoplexy of	256	Chloral hydrate, actions, uses and	
— congestion of	255	doses of	147
— diseases of	255	Chloride of lime, actions, uses and	
— weight of	64	doses of	147
Branding, method of	14	Choking, symptoms and treatment	251
— patent composition for	14	“Chowrung”	224
Brandy, actions, uses and doses of	145	“Chuna”	152
Breast-bone, description of	69	“Churbi”	141
Breast-strap	40	Chyme	105
Breeding	92	Cinchona bark, actions, uses and	
Bronchitis, causes, symptoms and		doses of	147
treatment	226	Cinnamon, actions, uses and doses of	147
“Butch”	159	Circulation, physiology of	102
“Butchnagh”	141	Circulatory system, anatomy of	81
Butea seed, actions, uses and doses of	145	— diseases of	229
“CABAUB CHINEE”	156	Clitoris	90
Calf, appearance at birth	97	Cloves, actions, uses and doses of	147
— diet (food)	97	Coal-tar, actions, uses and doses of	147
— manner of suckling	95	Cocoonut kernel and oil, actions, uses	
— measurements of	97	and doses of	147
— weight of	97	Colds, symptoms and treatment	225
Calomel, actions, uses and doses of	145	Colic, causes, symptoms and treat-	
Calotropis gigantea, actions, uses and		ment	248
doses of	145	— flatulent	249
Camp, securing elephants in, Govern-		— spasmodic	248
ment method	55	Colocynth, actions, uses and doses of	147
Camphor, actions, uses and doses of	145	Condy's fluid, actions, uses and doses	
— liniment compound	145	of	147
Camphorated oil	145	Constipation, causes, symptoms and	
Camping grounds, selection of	33	treatment	245
Cantharidis ointment	145	Copulation	92
Capillaries, definition of	81	Cordials, definition and examples of	118
Capsicums, actions, uses and doses of	145	Coriander fruit, actions, uses and	
Caraway seeds, actions, uses and doses		doses of	147
of	145	Cornea, inflammation of	264
		— opacity of	265
		— ulceration of	264

	PAGE		PAGE
Corrosive sublimate, actions, uses and doses of	147	Dung, characters of	238
"Cowardie," duties of	34—35	Dusting powder, definition and examples of	125
— pay of	38	Dysentery, causes, symptoms and treatment	244
Cracked heel	221	— epidemic	321
Cracked sole	220		
Cramp, causes and symptoms	200	EAR	99
Creosote, actions, uses and doses of	147	Eczema, causes, symptoms and treatment	205
— ointment	148	Elephant-pox, symptoms and treatment	315
Croton seeds, actions, uses and doses of	148	Embrocations, definition and examples of	126
— oil	148	Endurance, power of	28
Crupper	44	Enema, definition and examples of	127
Crupper-rope	44	— method of administering	128
Cubebs, actions, uses and doses of	148	— pumps	114
Cummin seeds, actions, uses and doses of	148	— uses of	127
Cupri sulphas, actions, uses and doses of	148	Enteritis, causes, symptoms and treatment	250
— lotion	148	Epsom salts, actions, uses and doses of	149
Custard-apple leaves, actions, uses and doses of	148	— "Erundi binj"	146
Cystitis, causes, symptoms and treatment	234	— "ka cuplee"	146
		— "ka tel"	146
"DALCHINI TAJ"	147	Escaped elephants, recapture of	54
"Darchini ka tel"	154	Eucalyptus oil, actions, uses and doses of	149
"Daroo"	143	— ointment	149
Debility, causes and general treatment of	168	Excretion, elementary physiology of	107
Destroying elephants, method of	58	Exposure, shelter from	32
"Dhanya"	147	Eye, anatomy of	98
Dhatura leaves, actions, uses and doses of	148	— diseases of	261
— seeds, actions, uses and doses of	148	— lachrymal apparatus of	99
"Dhuna"	157	— nictitating membrane	99
Diabetes, causes, symptoms and treatment	236	— ointment for	131
Diarrhoea, causes, symptoms and treatment	241	— powder	131
— in calves	242	— signs of disease of	99
— nervous	242	— washes	130
— parasitic	242		
Digestion, physiology of	104	FÆCES, characters of	238
Digestive system, anatomy of	83	Fallopian tubes	91
— tonics	118	Fats, action of bile on	105
Dikamali, actions, uses and doses of	148	— action of gastric juice on	105
— ointment	149	— action of pancreatic juice on	106
Dill seeds, actions, uses and doses of	149	— physiological consideration of	104
Disease, general causes and prevention of	15	Feeding	16
— infective, general remarks on	281	— times of	22
Dislocation, causes, symptoms and treatment	200	Fennel, actions, uses and doses of	149
Diuretics, definition and examples of	119	Fenugreek, actions, uses and doses of	149
Donovan's solution, actions, uses and doses of	149	Ferri carb. sacch., actions, uses and doses of	149
Dragging, gear for	39	— iodidum, actions, uses and doses of	149
Drugs, actions, uses and doses of	140—161	— perchlor. tinct., actions, uses and doses of	149
— employed in elephant treatment	140—161	— sulphas, actions, uses and doses of	149
— native names for	140—161	Fetters, uses of	42
— procurable in bazaar	138	— patterns of	49
— to be kept in elephant camps	138	— for grazing	51
		Fever	165

	PAGE		PAGE
Fever, general treatment of	167	"Goor"	151, 160
Filariasis	230	"Goor butch"	159
Fistula, definition and treatment of ..	196	Grass for feeding purposes	17
Flies, blood-sucking	210	— quantity required	17
— non-blood-sucking	213	Grazing, fettering for	51
— spider	214	"Gripes"	248
Flukes	271	"Gudge kai"	144
Fodder, Government scale of	24	Gullet	84
— natural	16	"Gumbeede"	157
— quantity allowable	20	"Gunchi"	140
— varieties of green	19	"Gunruss"	224
— vernacular names for	19		
Fomentations, definition of	131	HÆMATIDROSIS, causes, symptoms	
— method of application of	131	and treatment	208
Food, artificial	20	Hæmatopinus	215
— "mussauls"	21	Hæmaturia, causes, symptoms and	
— natural	16	treatment	235
— physiological consideration of ..	104	Hæmoglobin, function of	102
— "ratibs"	21	"Haing"	67
Foot, abscess of, causes, symptoms		Harderian gland	99
and treatment	222	Health, signs of	9
— anatomy of	71	Heart, anatomy of	81
— diseases of	218	— diseases of	229
— inflammation of	219	— weight of	82
— tender, causes, symptoms and		Heat apoplexy	259
treatment	218	— exhaustion, causes, symptoms	
Foot-chain, uses of	42	and treatment	258
Foot-and-mouth disease, causes,		— stroke	259
symptoms and treatment	313	Height, method of ascertaining ..	4
— in other animals	315	Hellebore, actions, uses and doses of	150
Forceps	113	Hemp, Indian, actions, uses and doses	
Fore-limb, anatomy of	70	of	150
Formulae	117—137	Hind-limb, anatomy of	71
Fractures, classification, symptoms		"Hing"	143
and treatment	199	Hippoboscideæ	214
Friar's balsam, actions, uses and doses		Honey, actions, uses and doses of ..	151
of	149	Hoof-slipper, anatomy of	71
		"Huldee"	151, 160
GALLS, definition, causes and treat-		Hydatid	276
ment	202	Hydrargyri iodidum rubrum ointment,	
— oak, actions, uses and doses of ..	149	actions, uses and doses of	151
"Ganadan"	157	Hygiene, general, summary of	48
"Gandhak"	159	Hyoscyamus, actions, uses and doses of	151
Ganja, actions, uses and doses of ..	150	Hypodermic injections	111
Garlic, actions, uses and doses of ..	150	— method of administration	112
Gastric juice, nature and functions of	105		
Gear, adjustment of	39—40	ICTERUS, causes, symptoms and treat-	
— care of	47	ment	231
— for dragging	39	Identification, marks of	13
— Government pattern	42	"Ilachi"	145
— pack	42	Ill-health, general indications of ..	165
— Sanderson's improved pattern ..	42	"Imhli"	159
Generative system, anatomy of	90	Impregnation	91
Gentian, actions, uses and doses of ..	150	"Inderjou"	143
— "Geong ka atta"	161	Indigestion, acute	238
Gestation, period of	95	— chronic	239
"Ghee"	150	Indisposition, signs of	9
Ginger, actions, uses and doses of ..	150	"Indrayen"	147
Girths	40	Injections, definition and examples of	132
— pack	43	Instruments, care of	115
Glycerine, actions, uses and doses of	150	— list of necessary	113
"Gök-see"	40	Intestines, anatomy of	85
"Googul"	144	— diseases of	238
"Goond"	140		

	PAGE		PAGE
Intestines, intussusception of ..	246	Labour, process of	96
— length of small	85	— treatment after	95—97
— length of large	86	“ Lal kaneri ”	155
— movements of	106	Laminitis, causes, symptoms and treat-	
— obstruction of	246	ment	219
— Owen's measurements of ..	86	Larynx	79
Iodine, actions, uses and doses of ..	151	“ Lassun ”	150
— liniment	151	“ Lauban ”	144
— ointment	151	“ Lavung ”	147
— tincture	151	Laxative, definition and examples of ..	120
Iodoform, actions, uses and doses of ..	151	Lead acetate, actions, uses and doses of ..	152
		— lotion	152
JAEPHUL	154	— subacetate liq.	152
Jaggery	151	Leeches	217
“ Jamal gotah ”	148	Lemon juice	152
“ Jangli kana ”	159	Lice	215
Jaundice, causes, symptoms and treat-		Lightning-stroke	260
ment	231	Lime, actions, uses and doses of ..	152
“ Jeera suffaid ”	145	— water	152
Jemadar, duties of	34—35	Linseed meal	152
“ Jepal ”	148	— oil	152
Jinjili leaves, actions, uses and doses		Liquor ammonia, actions, uses and	
of	151	doses of	152
— oil	151	— acetate	152
— seeds	151	Liquor arsenicalis, actions, uses and	
		doses of	152
“ KABAB CHINI ”	148	Liquorice root, actions, uses and doses	
“ Kafur ”	145	of	152
“ Kahdee kahri kahrum ”	143	Liver, anatomy of	86
“ Kakar singi ulday ”	151	— diseases of	231
“ Kala bitch wa ”	150	— rupture of	232
“ Kalaga ”	11	— weight of	86
“ Kala jeera ”	148	Loading rope	44
“ Kala nimuch ”	157	Loins, injury to	199
“ Kali mirchi ”	155	Lotions, definitions and examples of ..	132
“ Kanil ”	155	Lungs, appearance in health	79
“ Kapoor ”	99	— description of	79
“ Kapoor ”	145	— inflammation of	227
“ Karbi ”	155	— weight of	79
“ Kari khar ”	143	Lymph, composition of	102
“ Kat, katha ”	146	Lymphangitis, causes, symptoms and	
“ Kela ”	156	treatment	236
Kerosene oil, actions, uses and doses		Lymphatic system, anatomy of	81
of	151	— leukæmia	278
“ Khary mitti ”	146	MACE, actions, uses and doses of	153
“ Khopra ”	147	Maggots	213
“ Khorasani ajwan ”	151	Mahout, duties of	34
Kidneys, description and weight of ..	88	— offences by	36
— inflammation of	233	“ Mah phul ”	149
“ Kil alkatra ”	156	Mango tree bark, actions, uses and	
“ Kiramar ”	157	doses of	153
Knives, hoof	114	— seeds	153
Kootkie, actions, uses and doses of ..	151	Margosa bark, actions, uses and doses	
“ Kuchila ”	154	of	153
“ Kuchla ”	154	— fruit	153
“ Kumree ”	256	— leaves	153
“ Kutki ”	151	— oil	153
“ Kwechee ”	40	— toddy	153
“ Kya-pazat,” uses of	54	— tree	153
		“ Mavthi ”	149
LABOUR in wild state	96—97	“ Maythee suva ”	149
— period of	96	“ Mazu phul ”	149
		Measure glasses	114

	PAGE		PAGE
Measurements, details of, in three		Nervous system, diseases of ..	255
hundred elephants	5	— elementary description of ..	98
— method of taking	4	Nettle-rash	205
Medicines, administration of ..	110	“Nga-phai-kôn”	12
— doses of	109	“Nila tuta”	148
— preparation of	110	“Nim ka nira”	153
Membrane, mucous	74	“Nimboo ka rus”	152
— serous	75	“Nimuch”	157
Mesentery	75	“Noanisoo”	142
Milk	91	Nose, anatomy of	76
— actions of	153	“Nowsagar”	142
— sour	153	Numdah	39
“Mirch”	145	Nutmeg, actions, uses and doses of ..	154
“Mitha tel”	151	Nux vomica, actions, uses and doses of ..	154
“Mitta lukhre”	152	— extract of, actions, uses and doses	
“Mom”	161	of	149
“Monz ka jud”	156		
“— putta”	156	ŒSOPHAGUS, description of ..	84
“Mookunda”	254	— obstruction of	251
“Moolce”	157	“Ohn-dones”	39
“Moosabbar ilva”	142	— description of	41
Moringa bark and roots, actions and		Oil of cinnamon, actions and uses of ..	154
uses of	154	— of olives, actions and uses of ..	154
— flowers, actions and uses of ..	154	— of turpentine	155
— leaves, actions and uses of ..	154	Oils, definition and examples of ..	133
Mortar and pestle	114	Ointments, definition and examples of ..	134
“Morthutha”	148	Oleander, actions, uses and doses of ..	155
“Mothea beenj”	265	“Omam”	145
“Moungdoug”	11	Onions, actions, uses and doses of ..	155
Mounting	49	“Oosie,” duties of	34
Mouth, description of	83	— offences of	36
— inflammation of	173	— pay of	38
“Mudar”	145	Operations, securing for	51
“Mudh”	151	— crushes for	52
“Mula”	157	Ophthalmia, causes, symptoms and	
Mumps	226	treatment	263
“Munge”	154	Opium, actions, uses and doses of ..	155
MurRAIN	321	— tinct. of, actions, uses and doses of ..	155
Muscular system, tendinous fibre in ..	75	Ovaries, description of	91
“Mussauls,” effect of, on digestive organs	22		
— examples of	118—119	PACES	31
— some formulæ for	136—137	Pack-gear	42
Mustard, actions, uses and doses of ..	154	“Pai-chaik”	35
— oil	154	Pain, general treatment of	168
“Musth”	175	Paints, definition and examples of ..	135
“Muttee ka tel”	151	— “Pai-si,” duties of	35
Myrrh, actions, uses and doses of ..	154	— pay of	38
		“Pa-ket-hlwe”	12
NAILS, diseases of	223	“Pakhan bed”	150
— ingrowing	223	“Palas ka binj”	145
— moisture round and under the ..	223	“Palas papra”	145
— number in each foot	12	Pancreas	87
— overgrown	223	“Papaiya”	155
— warty growths around the ..	223	Papaw tree leaves, actions, uses and	
“Narial ka tel”	147	doses of	155
Neck-rope	44	— juice, actions, uses and doses of ..	155
Needles, suturing	113	“Papaya ka putta”	155
— setoning	113	“Para ka khan”	145
— method of using	113	Paralysis of ear flap	257
“Neem ka chhal”	153	— reflex	257
“— putta”	153	— of trunk	257
“— tel”	153	Paraplegia, causes, symptoms and	
Nephritis, causes, symptoms and		treatment	256
treatment	233		

	PAGE		PAGE
Parasites in alimentary canal ..	267	Poultices, definition and examples of	136
— external	210	— boots for	136
— internal	267	Pregnancy	94
Parturition, process of	96	— duration of	95
"Peear"	155	— occurrence of	94
Pelvis, anatomy of	70	— signs of	94
Penis, description of	90	— treatment during	94
Pepper, black, actions, uses and doses		Probes, uses of	114
of	155	Proteins, nature of	104
— long, actions, uses and doses of	155	Protoplasm, definition of	100
Peppermint, actions, uses and doses of	155	Ptyalin, nature of	105
Peritonitis, causes, symptoms and		"Pudina"	155
treatment	251	Pulse, definition of	82
Pepsin, definition of	105	— significance of	82
Peptones, definition of	105	— varieties of	82
Peritoneum	75	— where to feel the	82
Phenyle, actions, uses and doses of ..	155	Pulse-rate in elephants	82
"Phitkari"	142	Purchase, examination before	8—9
"Phutkee"	142	Purgatives, definition and examples of	120
Physiology, elementary	100	"Pyat-that-kôn"	12
Pimenta, actions, uses and doses of	155	"Pyazwe"	11
Piper cubeba, actions, uses and doses		Pyæmia, causes, symptoms and treat-	
of	156	ment	285
"Piplee"	155		
Piroplasmosis	311	QUICKSANDS, crossing of	57
Pityriasis, causes, symptoms and		Quinine sulph., actions, uses and doses	
treatment	204	of	157
Pix liquida, actions, uses and doses of	156		
Placenta, definition of	91	RABIES	317
Plantain, actions, uses and doses of	156	Radish, actions, uses and doses of ..	157
— tree root, actions, uses and doses		"Rai"	154
of	156	"Ral rosina"	157
— tree leaves, actions, uses and doses		"Ras kapur"	145
of	156	"Ratibs," composition of	21
Plasma, definition (nature) of	101	Rations, Government scale of	22
Pleura	75	"Rat karanj"	144
Pneumonia, causes, symptoms and		Rennin, nature of	105
treatment	227	Resin, actions, uses and doses of ..	157
— epidemic	321	Resin ointment	157
— traumatic	228	Respiratory organs, anatomy of ..	76
Points of a good elephant	9	— diseases of	225
— undesirable	10	— physiology of respiration	106
Poisoning	252	— signs of disease in	80
— blood	285	— special movements of	107
— septic	285	Rest	31
Poisons, antidotes to	253	Restraint, methods of	49
Pomegranate rind, actions, uses and		"Revunchinee"	157
doses of	157	Rheumatism, causes, symptoms and	
— root, actions, uses and doses of	157	treatment	200
— bark	157	Rhubarb, actions, uses and doses of	157
"Poovina"	158	Ribs, anatomy of	70
Poppy capsules, actions, uses and		Rinderpest, insusceptibility of ele-	
doses of	156	phant to	321
"Posht"	156	— symptoms in other animals	322
Potass. acetate, actions, uses and doses		"Rita"	158
of	157	Rivers, crossing of	57
— bicarbonate, actions, uses and		"Rot" in elephants	272
doses of	156	— symptoms and treatment of	275
— bromide, actions, uses and doses of	156	Runaways, recapture of	54
— chlorate, actions, uses and doses		Rupture of vessels	230
of	156		
— iodidi, actions, uses and doses of	157	"SABOON"	157, 158
— nitras, actions, uses and doses of	156	Saddles	39
— permanganas, actions, uses and			
doses of	156		

	PAGE		PAGE
Saddles, pack	43	"Sohaga"	144
Saddling, instructions for	45	"Sohnt"	150
"Sa-gaw-waing"	12	"Somul"	140
"Salai"	144	"Sonf"	142
Sales	12	"Sonffe"	149
"Sallaki"	144	"Soolay," uses of	42
Salt, common, actions, uses and doses		"Soopari"	143
of	157	"Soorma"	143
Saw	114	Sore-throat, causes, symptoms and	
Scalds, treatment of	197	treatment	226
Scales and weights	114	Sounds produced by elephants	78
Scalpels	114	Spearmint, actions, uses and doses of	158
Scissors	114	Spine, anatomy of	68
Scurf, causes, symptoms and treatment	204	Spirits, æther, actions, uses and doses	
"Seeta phul ka putta"	148	of	158
"Sengna"	154	— æther nitrous, actions, uses and	
Septicæmia	285	doses of	158
— hæmorrhagic, causes, symptoms		— ammon. aromatic, actions, uses	
and treatment	302	and doses of	159
— puerperal, symptoms and treat-		— camphor, actions, uses and doses of	159
ment	286	— rectificatus, actions, uses and doses	
Serum, nature and composition of	101	of	159
Seton, definition and uses of	113	Spleen, description and weight of	87
— method of inserting	113	— diseases of	232
"Shabad"	151	— rupture of	233
"Shath"	151	Sprains, causes, symptoms and treat-	
"Shavier"	147	ment	198
"Shegata pan"	154	Squills, Indian, actions, uses and doses	
Shooting elephants	58	of	159
"Shora"	156	Staphyloma, causes, symptoms and	
"Shora ka tezaab"	141	treatment	265
"Singaug"	34—35	Sternum	69
"Sin-ök," duties of	34—35	Stomach, anatomy of	84
— pay of	38	— diseases of	238
Sinus, definition and treatment of	196	— size of	84
"Sirka"	161	Stomatitis, causes, symptoms and	
"Sital chini"	156	treatment	173
Skeleton	61	Subnitrate of bismuth	159
Skin, bleeding of	208	Suckling, method of	95
— description of	73	"Suckur"	159
— diseases of	202	"Sufed sunbul"	140
— inflammation of	202	"Suffed tuta"	161
— unhealthy signs	74	Sugar, coarse, actions, uses and doses	
Skull, inflammation of cavities of	255	of	159
— structure of	63	Sulphur, actions, uses and doses of	159
— sinuses of	64	— oint., actions, uses and doses of	159
— weight of	64	Sunstroke	258
Sleep	31	Super-purgation, causes, symptoms	
Sling	40	and treatment	243
Snake-bite	184	Surfeit	205
Snake roots, actions, uses and doses of	157	"Surra"	305
Soap, bar, actions, uses and doses of	157	Suttoo, actions, uses and doses of	159
— country, actions, uses and doses of	158	Swallowing, physiology of	105
— enema, actions, uses and doses of	158	Sweet flag, actions, uses and doses of	159
— hard, actions, uses and doses of	157	Syringes	114
— lin co., actions, uses and doses of	158		
— nuts, actions, uses and doses of	158	"TAJ KA TEL"	154
— soft, actions, uses and doses of	158	Tamarind pulp, actions, uses and doses	
Sodæ bicarb., actions, uses and doses		of	159
of	158	Tar ointment, actions, uses and doses of	159
— carb., actions, uses and doses of	158	"Tarpin tel"	155
— hypsulphite, actions, uses and		"Te"	67
doses of	158	Teeth, anatomy of	65
— sulphite, actions, uses and doses		— caries of	174
of	158		

	PAGE		PAGE
Teeth, development of	65	Urine, characters of normal	88
— disorders and irregularities of ..	173	— frequency of voiding	88
— replacement of	66	— retention of	234
“Tein-nyun-sa”	12	Urticaria, causes, symptoms and treat-	
Temperature, normal	166	ment	205
— method of taking	166	Uterus, description and length of ..	90
Temporal glands, congestion of ..	175		
— inflammation of	177	VAGINA, description and length of ..	90
— situation of	99	Value	7
Testicles, description of	90	— of timber elephants	8
Tetanus, causes, symptoms and treat-		— of trained tuskers	8
ment	318	— of trained baggage elephants ..	8
Tethering	50	Veins, definition of	81
— chains	50	Verdigris, actions, uses and doses of	161
Thermometer, clinical	113	Vermicides, definition and examples of	123
— method of using	166	Vertebræ, cervical	68
Thorax, anatomy of	76	— caudal	69
“Thut”	305	— dorsal	69
Thymol, actions, uses and doses of ..	159	— lumbar	69
“Tib”	151	— sacral	69
“Tick fever”	311	Vinegar, actions, uses and doses of ..	161
Ticks	215	Vomiting	251
“Til ka tel”	151	Vulva	90
Tissues, general consideration of ..	100		
Tobacco decoction, actions, uses and		WARBLES	213
doses of	160	Watering	24
— infusion	160	— times of	25
— leaves	160	— amount required	24
Toe-nails, number of	72	Wax, actions, uses and doses of ..	161
Tonics, definition of	121	Weight of carcase	6
— digestive	118	— of live animal	7
Trypanosomiasis	305	— of Government loads	27
Tushes, anatomy of	66	— used by mahouts	116
— in males	67	Weights and measures	115
Tusks, anatomy of	66	“Wet-kôn”	12
— cutting the	174	Wheat flour, actions, uses and doses of	161
— treatment of split	174	“Windstroke”	256
— weight of	68	Work	25
Treacle, actions, uses and doses of ..	160	— inspection before and after ..	28
Treatment, general, in sickness ..	163	— times of	25
Trunk, anatomy of	77	Worms in elephant	269
Tuberculosis	319	— round	268
“Tumhakoo”	160	— treatment for	270
Turmeric, actions, uses and doses of	160	Wounds, definition of	179
Tympanites, causes, symptoms and		— dressing of	184
treatment	277	— general treatment of	180
		— healing of	185
“UDDARUCK”	150	— poisoned wounds	184
Udder, description of	91	— removal of foreign bodies from ..	181
“Ujman,” actions, uses and doses of	160	— strapping for	181
“Ujwan,” actions, uses and doses of	160	— suturing of	182
Ulceration, causes of	190	— tiger-wounds	185
— chronic	192	— varieties of	179
— classification of	190		
— definition of	190	“ZANGAR”	161
— of ears	195	Zinc chloride liq., actions, uses and	
— of elbows	193	doses of	161
— of forehead	194	— lotion, actions, uses and doses of	161
— of tail	195	— ointment, actions, uses and doses	
— spreading ulcers	191	of	161
Ureters	88	— oxide, actions, uses and doses of	161
Urethra	88	— sulphate, actions, uses and doses	
Urinary system, anatomy of	88	of	161
— signs of disease in	89		
Urine, bloody	235		

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